FENOC

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December 21, 2011
L-11-320

10 CFR 50, Appendix E

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

SUBJECT:
Beaver Valley Power Station, Unit Nos. 1 and 2
Docket No. 50-334, License No. DPR-66
Docket No. 50-412, License No. NPF-73
Request NRC Approval of Proposed Beaver Valley Power Station, Unit Nos. 1 and 2 Emergency Preparedness Plan Using Nuclear Energy Institute 99-01 Revision 5 Methodology

Pursuant to 10 CFR 50, Appendix E, Section IV.B, FirstEnergy Nuclear Operating Company (FENOC) requests Nuclear Regulatory Commission (NRC) review and approval of a proposed revision to the Beaver Valley Power Station, Unit Nos. 1 and 2 (BVPS) Emergency Preparedness Plan. The proposed revision consists of replacing the current emergency action level scheme with the scheme described in Nuclear Energy Institute 99-01, "Methodology for Development of Emergency Action Levels," Revision 5, and as clarified by a series of frequently asked questions associated with the Nuclear Energy Institute methodology.

Attached is an evaluation supporting the proposed BVPS Emergency Preparedness Plan revision. Included in the evaluation is a copy of the proposed Emergency Preparedness Plan revision changes.

Beaver Valley Power Station, Unit No. 1 has a refueling outage in the spring. An evaluated emergency preparedness exercise is scheduled for June 2012. FENOC requests approval of the proposed Emergency Preparedness Plan revision by July 2, 2012 with implementation of the plan to be completed within five months following NRC approval to allow for time to train personnel on the proposed plan and to avoid implementation during the outage and scheduled exercise.

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NRR

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Phil H. Lashley, Supervisor - Fleet Licensing, at (330) 315-6808.

Sincerely,

Paul A. Harden

Attachment:
Evaluation of Proposed Beaver Valley Power Station, Unit Nos. 1 and 2 Emergency Preparedness Plan Revision

cc: NRC Region I Administrator
NRC Resident Inspector
NRC Project Manager
Director BRP/DEP
Site Representative BRP/DEP

Evaluation of Proposed Beaver Valley Power Station, Unit Nos. 1 and 2
Emergency Preparedness Plan Revision

1.0 SUMMARY DESCRIPTION

The Emergency Preparedness Plan (EPP) for the Beaver Valley Power Station, Unit Nos. 1 and 2 (BVPS) has an emergency action level (EAL) scheme currently based upon Nuclear Utilities Management and Resources Council (NUMARC)/National Environmental Studies Project (NESP)-007, "Methodology for Development of Emergency Action Levels [EALs]." FirstEnergy Nuclear Operating Company (FENOC) requests approval to replace the current BVPS EAL scheme with the scheme described in Nuclear Energy Institute (NEI) 99-01, "Methodology for Development of Emergency Action Levels," Revision 5 (Reference 1), as clarified by a series of NRC-accepted frequently asked questions (FAQs) on the NEI methodology.

2.0 PROPOSED EMERGENCY PLAN EAL REVISION

NEI 99-01, Revision 5 was accepted for use by the Nuclear Regulatory Commission (NRC) as stated in a letter to NEI dated February 22, 2008 (Reference 2). On November 9, 2009, NEI submitted a series of FAQs that clarified portions of NEI 99-01, Revision 5, to the NRC for review. By NRC memorandum dated September 17, 2010 (Reference 3), the NRC stated that they performed a technical review of the FAQs and accepted the disposition of a number of them.

The proposed revision to the BVPS EPP EALs will provide a site specific version of the NEI 99-01, Revision 5 EALs as clarified by the NRC-accepted FAQs.

The proposed BVPS EPP revision includes changes to EPP Section 1, "Definitions" (Appendix 1); Section 4, "Emergency Conditions" (Appendix 2); and Appendix G, "References" (Appendix 3).

Emergency Preparedness Plan, Section 1 contains the definitions and acronyms associated with the proposed EALs. Due to the number of changes to existing definitions/acronyms and the addition of new definitions/acronyms that support the proposed EALs, the Appendix only contains the final proposed pages. Note the superscript designator, Cxx, is used to identify reference documents contained in Emergency Preparedness Plan, Appendix G, "References." The designator will be completed upon approval of the proposed EPP revision.

Emergency Preparedness Plan, Section 4 contains the proposed EALs for each unit with the supporting bases and justifications. Due to the number of changes associated with the proposed revision, the Appendix only contains the final proposed pages. Note the superscript designator, Cxx, is used to identify reference documents contained in Emergency Preparedness Plan, Appendix G, "References." The designator will be completed upon approval of the proposed EPP revision.

Emergency Preparedness Plan, Appendix G contains the revision history of the BVPS EPP. The change supporting the proposed EALs is marked with revision bars.

Appendices 4 and 5 contain an EAL evaluation for each unit describing the differences and deviations in the proposed BVPS EALs from the NEI 99-01 Revision 5. Differences from the NEI guidance are, in general, administrative changes that do not affect the intent of the EALs. Deviations from the NEI guidance reflect site specific design and operating characteristics, and clarification of EAL intent. The bases for the differences and deviations are included in these Appendices.

For ease of use of the proposed EALs, a set of Wallboards has been developed. The Wallboards are included as Appendix 6.

Appendix 7 contains several calculations that were developed to support the proposed EALs. These calculations are being provided to aid in the NRC's review of the proposed EALs. A compact disk that contains other supporting documents such as plant procedures and technical specifications, which would also aid in the NRC's review, is being sent under separate cover.

NEI 99-01, Revision 5, contains an EAL for Independent Spent Fuel Storage Installations (ISFSI). Since FENOC will be constructing an ISFSI at the BVPS site for each of the units, the ISFSI EAL was added to the proposed BVPS EAL schemes, consistent with the NEI guidance. This EAL will not be used until the ISFSI has been placed into service.

3.0 REGULATORY ANALYSIS

The relevant regulatory requirements and NRC guidance for the BVPS EPP EAL scheme change are described in the excerpts below.

10 CFR 50.47(b)(4)

> A standard emergency classification and action level scheme, the bases of which include facility system and effluent parameters, is in use by the nuclear facility licensee, and State and local response plans call for reliance on information provided by facility licensees for determinations of minimum initial offsite response measures.

10 CFR 50 Appendix E, Section IV.B

> The means to be used for determining the magnitude of, and for continually assessing the impact of, the release of radioactive materials shall be described, including emergency action levels that are to be used

> as criteria for determining the need for notification and participation of local and State agencies, the Commission, and other Federal agencies, and the emergency action levels that are to be used for determining when and what type of protective measures should be considered within and outside the site boundary to protect health and safety. The emergency action levels shall be based on in-plant conditions and instrumentation in addition to onsite and offsite monitoring ... A revision to an emergency action level must be approved by the NRC before implementation if: (1) The licensee is changing from one emergency action level scheme to another emergency action level scheme ... (2) The licensee is proposing an alternate method for complying with the regulations ...

Regulatory Guide 1.101

Regulatory Guide 1.101, "Emergency Response Planning and Preparedness for Nuclear Power Reactors," Revision 5, provides the criteria and recommendations the NRC staff considers acceptable for complying with the requirements in 10 CFR 50, Appendix E and 10 CFR 50.47(b) for onsite emergency plans. Revision 4 of the regulatory guide indicated that NEI 99-01, Revision 4 provided an acceptable method for developing EALs required by 10 CFR 50, Appendix E, Section IV and 10 CFR 50.47(b)(4).

By letter dated February 22, 2008, from Mr. Christopher G. Miller, NRC Deputy Director for Emergency Preparedness, to Mr. Alan Nelson, Nuclear Energy Institute (Reference 2), the NRC stated that NEI 99-01, Revision 5 addressed lessons learned from the implementation of NEI 99-01, Revision 4; security-related EALs modified by NRC Bulletin 2005-02, "Emergency Preparedness and Response Actions for Security-Based Events;" and EALs modified as a result of the FAQ process. The letter further stated:

> My staff reviewed NEI 99-01, Revision 5, dated February 2008, (ADAMS Accession No. ML080450149) and found it acceptable for use as a methodology to develop an EAL scheme. The NRC will pursue endorsement of NEI 99-01, Revision 5, using Regulatory Guide 1.101. While the NRC is pursuing endorsement, licensees may use this version of NEI 99-01 as a basis for making changes to their EALs.

Analysis

The Emergency Plan for BVPS has an EAL scheme that is currently based upon the NUMARC/NESP-007 guidance. The proposed BVPS EAL scheme is based upon the scheme contained in the NRC-accepted version of NEI 99-01, Revision 5, as clarified by

the NRC-accepted FAQs. An evaluation of the site-specific differences and deviations between the generic EAL scheme described in NEI 99-01, Revision 5 and the proposed BVPS EAL scheme is documented in Appendices 4 and 5. Since the NRC has accepted NEI 99-01, Revision 5 methodology for use in the development of an EAL scheme, it can be concluded that an EAL scheme using this methodology would satisfy the requirements of 10 CFR 50.47(b) and 10 CFR 50 Appendix E. Therefore, the proposed BVPS EAL scheme satisfies these regulatory requirements.

Prior to implementing a replacement EAL scheme, NRC review and approval is required pursuant to 10 CFR 50, Appendix E, Section IV.B. Therefore, consistent with this regulation, FENOC is requesting the NRC review and approval of the proposed BVPS EAL scheme.

4.0 REFERENCES

1. NEI 99-01, "Methodology for Development of Emergency Action Levels," Revision 5 (February 2008) (ADAMS Accession No. ML080450149)

2. Letter dated February 22, 2008 from Mr. Christopher G. Miller (NRC) to Mr. Alan Nelson (NEI), Subject: "U.S. Nuclear Regulatory Review and Endorsement of NEI 99-01, Revision 5" (ADAMS Accession No. ML080430552)

3. Memorandum dated September 17, 2010 from Mr. Joseph D. Anderson (NRC) to Mr. Kevin Williams (NRC), Subject: "Closure of Emergency Preparedness Frequently Asked Questions" (ADAMS Accession Nos. ML102580901)

5.0 APPENDICES

1. Proposed Beaver Valley Power Station, Unit Nos. 1 and 2 Emergency Preparedness Plan Revision to Section 1, "Definitions"

2. Proposed Beaver Valley Power Station, Unit Nos. 1 and 2 Emergency Preparedness Plan Revision to Section 4, "Emergency Conditions"

3. Proposed Beaver Valley Power Station, Unit Nos. 1 and 2 Emergency Preparedness Plan Revision to Appendix G, "References"

4. Beaver Valley Power Station Unit No. 1 EAL Evaluation

5. Beaver Valley Power Station Unit No. 2 EAL Evaluation

6. Proposed Beaver Valley Power Station, Unit Nos. 1 and 2 EAL Wallboards

7. Beaver Valley Power Station Unit Nos. 1 and 2 Supporting Calculations

Appendix 1
L-11-320

Proposed Beaver Valley Power Station, Unit Nos. 1 and 2
Emergency Preparedness Plan Revision to Section 1, "Definitions"
(Eighteen pages follow)

SECTION 1

DEFINITIONS

Effective Date – XXXXXX

Section 1

DEFINITIONS

Table of Contents

1. DEFINITIONS

The terms defined in this section are those which are used in special context in this document and/or are unique to the Beaver Valley Power Station (BVPS).

1.1. **ACCOUNTABILITY** -- Process to ascertain the whereabouts of all personnel within the plant PROTECTED AREA fence. Process is completed through the use of a computerized access security system.

1.2. **AFFECTING SAFE SHUTDOWN** -- Event in progress has adversely affected functions that are necessary to bring the plant to and maintain it in the applicable Hot or Cold Shutdown condition. Plant condition applicability is determined by Technical Specification LCOs in effect. [Cxx]

Example 1: Event causes damage that results in entry into an LCO that requires the plant to be placed in Hot Shutdown. Hot Shutdown is achievable, but Cold Shutdown is not. This event is not "AFFECTING SAFE SHUTDOWN." [Cxx]

Example 2: Event causes damage that results in entry into an LCO that requires the plant to be placed in Cold Shutdown. Hot Shutdown is achievable, but Cold Shutdown is not. This event is "AFFECTING SAFE SHUTDOWN." [Cxx]

1.3. **ALERT** -- See definition for EMERGENCY CLASSIFICATION LEVEL. [Cxx]

1.4. **ASSESSMENT ACTIONS** -- Those actions taken during or after an accident to obtain and process information that is necessary to make decisions to implement specific emergency measures.

1.5. **ASSESSMENT FACILITY** -- A facility for evaluation of information, including instrument data, to assess the severity and scope of an emergency condition.

1.6. **BOMB** -- An explosive device suspected of having sufficient force to damage plant systems or structures. [Cxx]

1.7. **BEAVER VALLEY EMERGENCY RESPONSE SYSTEM** -- The BEAVER VALLEY EMERGENCY RESPONSE SYSTEM (BVERS) is a computer aided Voice Mail System to be utilized for ERO activation.

1.8. **BEAVER VALLEY SITE** -- The entire OWNER CONTROLLED AREA. Includes the BVPS Unit 1, BVPS Unit 2 and the EMERGENCY RESPONSE FACILITY.

1.9. **CIVIL DISTURBANCE** -- A group of persons violently protesting station operations or activities at the site. This event does not involve HOSTILE ACTIONS. Peaceful demonstrations are not CIVIL DISTURBANCES. [Cxx]

1.10. **COMPENSATORY INDICATIONS** -- Computer points, In-Plant Computer - IPC (U1), Inadequate Core Cooling Monitor - ICCM (U1) , Sequence of Events Recorder - SER (U1), Plant Computer System - PCS (U2), Plant Safety Monitoring System - PSMS (U2) and PI Data (ProcessBook®). [Cxx]

1.11. **CONFINEMENT BOUNDARY** -- The barrier(s) between areas containing radioactive substances and the environment. [Cxx]

1.12. **CONTAINMENT CLOSURE** -- The procedurally defined actions taken to secure primary containment and its associated structures, systems, and components as a functional barrier to fission product release under existing plant conditions. [Cxx]

1.13. **CONTROL ROOM** -- Area from which plant systems are operated and monitored.

1.14. **CORRECTIVE ACTIONS** -- Those emergency measures taken to terminate an emergency situation at or near the source of the problem.

1.15. **DOSE PROJECTION** -- A calculated estimate of the potential dose to individuals at a given location, normally OFFSITE; as determined from the quantity of radioactive material released and the appropriate meteorological transport and diffusion parameters.

1.16. **DRILL** -- A pre-planned training activity in which the participants are "walked" or "talked" through one or more procedures, or aspects of the Emergency Preparedness Plan.

1.17. **EMERGENCY ACTIONS** -- A collective term encompassing the Assessment, Corrective, and PROTECTIVE ACTIONS taken during the course of an emergency.

1.18. **EMERGENCY ACTION LEVEL (EAL)** -- A pre-determined, site specific, observable threshold for a plant IC that places the plant in a given EMERGENCY CLASSIFICATION LEVEL. An EAL can be: an instrument reading; an equipment status indicator; a measurable parameter (ONSITE or OFFSITE); a discrete, observable event; results of analyses; entry into specific EMERGENCY OPERATING PROCEDURES; or another phenomenon which, if it occurs, indicates entry into a particular EMERGENCY CLASSIFICATION LEVEL.

1.19. **EMERGENCY CLASSIFICATION LEVEL (ECL)** -- One of a minimum set of names or titles established by the NRC for grouping off normal nuclear power plant conditions according to (1) their relative radiological seriousness, and (2) the time-sensitive ONSITE and OFFSITE radiological emergency preparedness actions necessary to respond to such conditions. The existing radiological EMERGENCY CLASSIFICATION LEVELS, in ascending order of seriousness, are called: [Cxx]

- <u>**UNUSUAL EVENT**</u> -- Events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring OFFSITE response or monitoring are expected unless further degradation of safety systems occurs. [C46]

- <u>**ALERT**</u> -- Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA PROTECTIVE ACTION GUIDE exposure levels. [C46 Cxx]

- <u>**SITE AREA EMERGENCY**</u> -- Events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts; 1) toward site personnel or equipment that could lead to the likely failure of or; 2) that prevent effective access to, equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PROTECTIVE ACTION GUIDE exposure levels beyond the site boundary. [C46 Cxx]

- <u>**GENERAL EMERGENCY**</u> -- Events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PROTECTIVE ACTION GUIDE exposure levels OFFSITE for more than the immediate site area. [C46 Cxx]

1.20. **EMERGENCY COORDINATORS** -- Designated BVPS staff members responsible for coordinating specific emergency organization functions. These coordinating positions are:

- (CONTROL ROOM) Operations Coordinator
- TSC Operations Coordinator
- EOF Operations Coordinator

- Communications and Records Coordinator
- Technical Support Coordinator
- OPERATIONS SUPPORT CENTER Coordinator
- Radiological Controls Coordinator
- Maintenance Coordinator
- Environmental Assessment and DOSE PROJECTION Coordinator
- Engineering Coordinator
- Security Coordinator
- Chemistry Coordinator
- Environmental Coordinator
- Computer Coordinator
- OPERATIONS SUPPORT CENTER Health Physics Coordinator[C15]
- Nuclear Communications/Onsite Coordinator

1.21. **EMERGENCY MANAGERS** -- Designated BVPS staff members responsible for coordinating specific emergency organization functions. These positions, primarily located in the EOF, are activated upon classification of a SITE AREA or GENERAL EMERGENCY and include:

- EMERGENCY/RECOVERY MANAGER
- Support Services Manager
- Nuclear Communications Manager
- Offsite Agency Liaison

1.22. **EMERGENCY DIRECTOR** -- The BVPS individual responsible for direction of ONSITE activities during any emergency at BVPS, and both ONSITE and OFFSITE activities during UNUSUAL EVENTS and ALERT Emergencies. The EMERGENCY DIRECTOR is the only individual authorized to declare an emergency condition, authorize emergency personnel radiation exposures greater than 10CFR20; and/or direct the issuance of KI.

1.23. **EMERGENCY IMPLEMENTING PROCEDURES** -- The detailed procedures which carry out the guidance of this Plan.

1.24. **EMERGENCY OPERATING PROCEDURES (EOP)** -- Those procedures utilized by the station operations staff in responding to CONTROL ROOM instrumentation alarms or indications (i.e., assessment and CORRECTIVE ACTIONS).

1.25. **EMERGENCY OPERATIONS CENTER (EOC)** -- Designated Federal, State, and County (i.e., Emergency or disaster services/management agencies) headquarters/facilities, especially designed and equipped for the purpose of exercising effective coordination and control for disaster operations carried out within their jurisdiction.

1.26. **NEAR-SITE EMERGENCY OPERATIONS FACILITY (EOF)** -- The near-site facility designated for providing overall coordination of the utility's emergency response and coordination with OFFSITE response agencies of the various jurisdictions for the protection of the general public. Space is provided for Federal, State, and local liaison officials. An OFFSITE EOF is provided as an alternate facility.

1.27. **EMERGENCY PLANNING ZONE** -- There are two EMERGENCY PLANNING ZONES (EPZ). The first is an area approximately 10 miles in radius around BVPS, for which emergency planning consideration of the plume exposure pathway has been given in order to ensure that prompt and effective actions can and will be taken to protect the public in the event of an accident. The second is an area approximately 50 miles in radius around BVPS for which emergency planning consideration of the ingestion pathway has been given.

1.28. **EMERGENCY/RECOVERY MANAGER** -- Upon classification of a SITE AREA or GENERAL EMERGENCY, the EMERGENCY/RECOVERY MANAGER assumes responsibility and authority for overall direction and coordination of the BVPS emergency response, with primary responsibility for coordination of OFFSITE activities (monitoring, logistics, interagency liaison). When activated, the EMERGENCY/RECOVERY MANAGER is the only individual authorized to make recommendations of OFFSITE PROTECTIVE ACTIONS to OFFSITE response agencies.

1.29. **EMERGENCY RESPONSE FACILITY (ERF)** -- The near-site facility provided by BVPS. Incorporates the TECHNICAL SUPPORT CENTER, the Emergency Operations Facility, the Dosimetry Area, Counting Room and other facilities.

1.30. **ESSENTIAL PERSONNEL** -- Those personnel deemed necessary to the protection of the health and safety of the general public. The personnel from the following groups, and any others deemed necessary, are considered to be ESSENTIAL PERSONNEL:

- Operations
- Radiation Protection
- Chemistry
- Security
- Emergency Response Organization personnel (including Primary, Secondary, Call-out and On-Shift personnel[C44])

1.31. **EXERCISE** -- A realistic, pre-planned simulation of an accident, designed and coordinated in such a manner that the response of the emergency organization and other station personnel closely approximates the response to an actual incident. An EXERCISE may involve participation of OFFSITE organizations.

1.32. **EXPLOSION** -- A rapid, violent, unconfined combustion, or catastrophic failure of pressurized/energized equipment that imparts energy of sufficient force to potentially damage permanent structures, systems, or components. [Cxx]

1.33. **EXTORTION** -- An attempt to cause an action at the station by threat of force. [Cxx]

1.34. **FAULTED** -- In a steam generator, the existence of secondary side leakage that results in an uncontrolled drop in steam generator pressure or the steam generator being completely depressurized. [Cxx]

1.35. **FIRE** -- Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute FIRE. Observation of flame is preferred but is not required if large quantities of smoke and heat are observed. [Cxx]

1.36. **GENERAL EMERGENCY** -- See definition for EMERGENCY CLASSIFICATION LEVEL.

1.37. **GROUND RELEASE** -- Release of radioactive effluents from the facility via the Reactor Building and supplementary leak collection system vent (located on top of the Reactor Building), the ventilation vent (located on top of the Auxiliary Building), the PROCESS VENT (located on the Cooling Tower), or any other release pathway.

1.38. **HOSTAGE** -- A person(s) held as leverage against the station to ensure that demands will be met by the station. [Cxx]

1.39. **HOSTILE ACTION** -- An act toward a nuclear power plant or its personnel that includes the use of violent force to destroy equipment, take HOSTAGES, and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, PROJECTILES, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. HOSTILE ACTION should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on the nuclear power plant. Non-terrorism-based EALs should be used to address such activities (i.e., violent acts between individuals in the OWNER CONTROLLED AREA). [Cxx]

1.40. **HOSTILE FORCE** – One or more individuals, who are engaged in a determined assault, overtly or by stealth and deception, equipped with suitable weapons capable of killing, maiming, or causing destruction. [C46]

1.41. **IMMINENT / IMPENDING** -- Means about to happen (generally within 30 minutes). [Cxx]

1.42. **INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI)** -- A complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage. [Cxx]

1.43. **INTRUDER / INTRUSION** -- A person(s) present in a specified area without authorization. Discovery of a BOMB in a specified area is indication of INTRUSION into that area by a HOSTILE FORCE. [Cxx]

1.44. **JOINT PUBLIC INFORMATION CENTER (JPIC)** -- The designated location from which news releases, press conferences, and other media interfacing can be provided.

1.45. **LARGE AIRCRAFT**– Any size or type of aircraft with the potential for causing significant damage to the plant (refer to the Security Plan for a more detailed definition).

1.46. **LOCAL AREA EVACUATION** -- Evacuation of personnel from localized affected areas within the station.

1.47. **NON-ESSENTIAL PERSONNEL** – Those personnel not determined to be ESSENTIAL PERSONNEL. [C44]

1.48. **NORMAL LEVELS** -- The highest reading in the past twenty-four hours excluding the current peak value. [Cxx]

1.49. **NORMAL PLANT OPERATIONS** -- Activities at the plant site associated with routine testing, maintenance, or equipment operations, in accordance with normal operating or administrative procedures. Entry into abnormal or EMERGENCY OPERATING PROCEDURES, or deviation from normal security or radiological controls posture, is a departure from NORMAL PLANT OPERATIONS. [Cxx]

1.50. **OFFSITE** -- Any area outside of the BVPS property boundary surrounding the BEAVER VALLEY SITE. [Cxx]

1.51. **ONSITE** -- See Definition for BEAVER VALLEY SITE.

1.52. **OPERATIONS SUPPORT CENTER (OSC)** -- The designated location for assembly of on-duty and relief operations, health physics and maintenance support personnel.[C15]

1.53. **OWNER CONTROLLED AREA** -- The property associated with the station and owned by the company. Access is normally limited to persons entering for official business. [Cxx]

1.54. **PRIMARY ASSEMBLY AREA** -- An area designated for the assembly of specific groups of individuals for ACCOUNTABILITY and/or in preparation for a plant evacuation within the PROTECTED AREA fence.

1.55. **PROCESS VENT** -- The effluent release path by which gaseous radioactive wastes are released following processing. The release point is located at the top of the cooling tower. In DOSE PROJECTION and accident analyses, this release pathway is considered a GROUND RELEASE.

1.56. **PROJECTILE** -- Means a fired, projected object, such as a bullet or pellet having no capacity for self propulsion directed towards a nuclear power plant that could cause concern for its continued operability, reliability or personnel safety. [Cxx]

1.57. **PROTECTED AREA** -- Means an area encompassed by physical barriers and to which access is controlled. [Cxx]

1.58. **PROTECTIVE ACTIONS** -- Those emergency measures taken after an uncontrolled release of radioactive material, for the purpose of preventing or minimizing radiological exposures.

1.59. **PROTECTIVE ACTION GUIDES (PAG)** -- Projected radiological dose rate or dose commitment values to individuals in the general population that warrant protective action following a release of radioactive material.

1.60. **RADIOLOGICAL EMERGENCY RESPONSE PLAN (RERP)** -- Detailed incident response plans developed by the State of Pennsylvania and its agencies and County and Municipal Emergency Management agencies in coordination with the Pennsylvania Emergency Management Agency (PEMA) and the fixed nuclear facility.

1.61. **RECOVERY ACTIONS** -- Those actions taken after the emergency to restore the station as nearly as possible to its pre-emergency conditions.

1.62. **REMOTE ASSEMBLY AREA** -- A designated area (or areas), outside the site, for the assembly of evacuated plant personnel during a SITE EVACUATION.

1.63. **RUPTURED** -- In a steam generator, existence of primary-to-secondary leakage of a magnitude sufficient to require or cause a reactor trip and safety injection. Cxx

1.64. **SABOTAGE** -- Deliberate damage, mis-alignment, or mis-operation of plant equipment with the intent to render the equipment inoperable. Equipment found tampered with or damaged due to malicious mischief may not meet the definition of SABOTAGE until this determination is made by security supervision. Cxx

1.65. **SECURITY CONDITION** -- Any Security Event as listed in the approved security contingency plan that constitutes a threat/compromise to site security, threat/risk to site personnel, or a potential degradation to the level of safety of the plant. A SECURITY CONDITION does not involve a HOSTILE ACTION. Cxx

1.66. **SITE ASSEMBLY** -- Process of gathering all personnel from areas within the PROTECTED AREA to PRIMARY ASSEMBLY AREAS.

1.67. **SITE AREA EMERGENCY** -- See definition for EMERGENCY CLASSIFICATION LEVEL.

1.68. **SITE EVACUATION** -- Evacuation of all NON-ESSENTIAL PERSONNEL within the BEAVER VALLEY SITE.

1.69. **STRIKE ACTION** -- A work stoppage within the PROTECTED AREA by a body of workers to enforce compliance with demands made on management. The STRIKE ACTION must threaten to interrupt NORMAL PLANT OPERATIONS. Cxx

1.70. **TECHNICAL SUPPORT CENTER (TSC)** -- A designated location where plant management coordination of emergency response is performed and where various Licensee, Federal, and vendor engineering disciplines can analyze the conditions within the reactor core during and after an accident to provide technical assessment of the accident and corrective action recommendations to the EMERGENCY DIRECTOR.

1.71. **UNAFFECTED AREA** -- Any area or location which is known to be not significantly affected by radiation levels or other hazardous conditions.

1.72. **UNISOLABLE** -- A breach or leak that cannot be promptly isolated. [Cxx]

1.73. **UNPLANNED** -- A parameter change or an event, the reasons for which may be known or unknown, that is not the result of an intended evolution or expected plant response to a transient. [Cxx]

1.74. **UNUSUAL EVENT** -- See definition for EMERGENCY CLASSIFICATION LEVEL.

1.75. **VALID** -- An indication, report, or condition, is considered to be VALID when it is verified by (1) an instrument channel check, (2) indications on related or redundant indicators, or (3) by direct observation by plant personnel, such that doubt related to the indicator's operability, the condition's existence, or the report's accuracy is removed. Implicit in this definition is the need for timely assessment. [Cxx]

1.76. **VISIBLE DAMAGE** -- Damage to equipment or structure that is readily observable without measurements, testing, or analysis. Damage is sufficient to cause concern regarding the continued availability or reliability of the affected structure, system, or component. Example damage includes: deformation due to heat or impact, denting, penetration, rupture, cracking, and paint blistering. Surface blemishes (e.g., paint chipping, scratches) should not be included. [Cxx]

1.77. **VITAL AREA** -- Means any area that contains VITAL EQUIPMENT.

1.78. **VITAL EQUIPMENT** -- Means any equipment, system, device, or material, the failure, destruction, or release of which could directly or indirectly endanger the public health and safety by exposure to radiation. Equipment or systems which would be required to function to protect public health and safety following such failure, destruction, or release are also considered to be vital. [Cxx]

2. ABBREVIATIONS

AC .... Alternating Current Cxx

AFW .... Auxiliary Feed Water Cxx

AOP .... Abnormal Operating Procedure

ATWS .... Anticipated Transient Without Scram Cxx

B&W .... Babcock and Wilcox Cxx

BCEMA .... Beaver County Emergency Management Agency

BVERS .... BEAVER VALLEY EMERGENCY RESPONSE SYSTEM

BVPS .... Beaver Valley Power Station

BWST .... Borated Water Storage Tank Cxx

CCEMA .... Columbiana County Emergency Management Agency

CCW .... Component Cooling Water Cxx

CDE .... Committed Dose Equivalent Cxx

CE .... Combustion Engineering Cxx

CFR .... Code of Federal Regulations Cxx

CR .... CONTROL ROOM

CSF .... Critical Safety Function

CSFST .... Critical Safety Function Status Tree Cxx

CVCS .... Chemical and Volume Control System Cxx

DBA .... Design Basis Accident

DC .... Direct Current Cxx

DEP/BRP .... Dept of Environmental Protection/Bureau of Radiation Protection (Pennsylvania)

DHR .... Decay Heat Removal Cxx

DOE .... Department of Energy (US)

DOT .... Department of Transportation Cxx

EAL .... EMERGENCY ACTION LEVEL

ECCS .... Emergency Core Cooling System

ECL .... EMERGENCY CLASSIFICATION LEVEL

ED .... EMERGENCY DIRECTOR

EOC .... EMERGENCY OPERATIONS CENTER

EOF .... EMERGENCY OPERATIONS FACILITY

EOP .... EMERGENCY OPERATING PROCEDURE

EPA .... Environmental Protection Agency Cxx

EPG .... Emergency Procedure Guideline Cxx

EPIP .... Emergency Plan Implementing Procedure Cxx

EPRI .... Electric Power Research Institute Cxx

EPZ .... EMERGENCY PLANNING ZONE

ERDS .... Emergency Response Data System

ERF .... EMERGENCY RESPONSE FACILITY

ERG .... Emergency Response Guideline Cxx

E/RM .... EMERGENCY/RECOVERY MANAGER

ESF .... Engineered Safety Feature

ESW .... Emergency Service Water Cxx

FAA .... Federal Aviation Administration Cxx

FBI .... Federal Bureau of Investigation Cxx

FEMA .... Federal Emergency Management Agency

FENOC .... First Energy Nuclear Operating Company

FPB .... Fission Product Barrier Cxx

FRMAP .... Federal Radiation Monitoring and Assessment Plan

FSAR .... Final Safety Analysis Report

GE .... GENERAL EMERGENCY [Cxx]

HCOEM .... Hancock County Office of Emergency Management [C47]

IC .... Initiating Condition [Cxx]

INPO .... Institute for Nuclear Power Operations

IPC .... Inplant Process Computer

IPEEE .... Individual Plant Examination of External Events (Generic Letter 88-20) [Cxx]

ISFSI .... INDEPENDENT SPENT FUEL STORAGE INSTALLATION [Cxx]

ITS .... Improved Technical Specifications [Cxx]

JPIC .... JOINT PUBLIC INFORMATION CENTER

Keff .... Effective Neutron Multiplication Factor [Cxx]

LEARN .... Law Enforcement Activity Radio Network

LER .... Licensee Event Report [Cxx]

LCO .... Limiting Condition for Operations

LOCA .... Loss of Coolant Accident

LRM .... Licensing Requirements Manual [Cxx]

LWR .... Light Water Reactor [Cxx]

MFW .... Main Feed Water [Cxx]

MIDAS .... Meteorological Information and Dose Assessment System

mR .... milliRoentgen [Cxx]

MSIV .... Main Steam Isolation Valve [Cxx]

MSL .... Main Steam Line [Cxx]

MSSV .... Main Steam Safety Valve [Cxx]

MW .... Megawatt Cxx

NAWAS .... National Warning System

NEI .... Nuclear Energy Institute Cxx

NESP .... National Environmental Studies Project Cxx

NORAD .... North American Aerospace Defense Command Cxx

NPP .... Nuclear Power Plant Cxx

NRC .... Nuclear Regulatory Commission (US)

NSSS .... Nuclear Steam Supply System Cxx

NUMARC .... Nuclear Management and Resources Council Cxx

OBE .... Operating Basis Earthquake Cxx

OCA .... OWNER CONTROLLED AREA Cxx

ODCM/ODAM .... Offsite Dose Calculation (Assessment) Manual Cxx

OEMA .... Ohio Emergency Management Agency

ORC .... Offsite Review Committee

ORO .... Offsite Response Organization Cxx

OSC .... OPERATIONS SUPPORT CENTER, or Onsite Safety Committee

PA .... PROTECTED AREA Cxx

PEMA .... Pennsylvania Emergency Management Agency

POAH .... Point of Adding Heat Cxx

PORV .... Power Operated Relief Valve Cxx

PRA/PSA .... Probabilistic Risk Assessment / Probabilistic Safety Assessment Cxx

PSIG .... Pounds pe Square Inch Gauge Cxx

PWR .... Pressurized Water Reactor Cxx

R .... Roentgen Cxx

RCC .... Reactor Control Console Cxx

RCCA .... Rod Cluster Control Assembly

RCDT .... Reactor Coolant Drain Tank Cxx

RCP .... Reator Coolant Pump

RCS .... Reactor Coolant System

REM .... Roentgen Equivalent Man Cxx

RPS .... Reactor Protection System Cxx

RPV .... Reactor Pressure Vessel Cxx

RVLIS .... Reactor Vessel Level Indicating System Cxx

SBO .... Station Blackout Cxx

SCBA .... Self-Contained Breathing Apparatus Cxx

SG .... Steam Generator Cxx

SI .... Safety Injection Cxx

SLCRS .... Supplemental Leak Collection and Release System Cxx

SPDS .... Safety Parameter Display System Cxx

SPING .... Special Particulate, Iodine, Noble Gas Monitoring System (Unit 1)

SRO .... Senior Reactor Operator Cxx

SSE .... Safe Shutdown Earthquake Cxx

TEDE .... Total Effective Dose Equivalent Cxx

TOAF .... Top of Active Fuel Cxx

TOP .... Temporary Operating Procedure

T/S .... Technical Specification

TID .... Technical Information Document

TSC .... TECHNICAL SUPPORT CENTER

UE .... UNUSUAL EVENT [Cxx]

WE .... Westinghouse Electric [Cxx]

WOG .... Westinghouse Owners Group [Cxx]

WRGM.. Wide Range Gas Monitor (Unit 2)

WVDHS/EM....... West Virginia Division of Homeland Security and Emergency Management [C47]

Appendix 2
L-11-320

Proposed Beaver Valley Power Station, Unit Nos. 1 and 2
Emergency Preparedness Plan Revision to Section 4, "Emergency Conditions"
(Three Hundred Twenty-Seven pages follow)

SECTION 4

EMERGENCY CONDITIONS

Section 4

EMERGENCY CONDITIONS

Table of Contents

Page No.

BVPS Unit No. 1 (BVPS-1)

EMERGENCY ACTION LEVELS and Basis

EMERGENCY CLASSIFICATION LEVEL (ECL)

One of a minimum set of names or titles established by the NRC for grouping off normal nuclear power plant conditions according to (1) their relative radiological seriousness, and (2) the time-sensitive ONSITE and OFFSITE radiological emergency preparedness actions necessary to respond to such conditions. The existing radiological EMERGENCY CLASSIFICATION LEVELS, in ascending order of seriousness, are called:

- UNUSUAL EVENT
- ALERT
- SITE AREA EMERGENCY
- GENERAL EMERGENCY

The ECLs are escalated from least severe to most severe according to relative threat to the health and safety of the public and emergency workers. An ECL is determined to be met by identifying abnormal conditions and then comparing them to INITIATING CONDITIONS (ICs) through EMERGENCY ACTION LEVELS (EALs) and Fission Product Barrier (FPB) threshold values as discussed below. When multiple EALs are met, event declaration is based in the highest ECL reached.

A state or phase called Recovery may be entered prior to returning to a normal organization and operation. Recovery provides dedicated resources and organizational structure in support of restoration and communication activities following the termination of the emergency event.

INITIATING CONDITIONS (ICs)

An IC is one of a predetermined subset of nuclear power plant conditions where either the potential exists for a radiological emergency, or such an emergency has occurred.

The ICs provide a general description of emergency conditions that are organized beneath the broader categories of the ECLs. The IC can be a continuous, measurable condition that is outside Technical Specifications, or it can encompass events such as FIRE or system/equipment failures.

Each IC is given a unique identification code. The prefix and the first letter identifies the recognition category, the second letter identifies the ECL, and the number (which can consist of two numerals) identifies the sequence of the IC within the recognition category. The EAL identification codes are developed as follows:

<u>Recognition Categories</u>

- F – Fission Product Barrier Degradation
- R – Abnormal Rad Levels / Radiological Effluent
- H – Hazards and Other Conditions Affecting Plant Safety

- S – System Malfunctions – Hot
- C – System Malfunctions – Cold (Cold Shutdown / Refueling System Malfunction)
- E – INDEPENDENT SPENT FUEL STORAGE INSTALLATION

EMERGENCY CLASSIFICATION LEVELS (lowest to highest)

- U – UNUSUAL EVENT
- A – ALERT
- S – SITE AREA EMERGENCY
- G – GENERAL EMERGENCY

EMERGENCY ACTION LEVELS (EALs) and Fission Product Barriers (FPBs)

An EAL is a pre-determined, site specific, observable threshold for a plant IC that places the plant in a given EMERGENCY CLASSIFICATION LEVEL. An EAL can be: an instrument reading; an equipment status indicator; a measurable parameter (ONSITE or OFFSITE); a discrete, observable event; results of analyses; entry into specific EMERGENCY OPERATING PROCEDURES; or another phenomenon which, if it occurs, indicates entry into a particular EMERGENCY CLASSIFICATION LEVEL.

EALs are individually identified by the IC identification code followed by the EAL number, such as RG1.1 for a major effluent release or HA3.2 for high winds.

Fission Product Barriers (FPBs) are given unique character identification codes and are further subdivided into loss and potential loss categories. Since meeting or exceeding one or more FPBs can result in various ECLs, the first two letters of the FPB are used to identify the particular barrier by abbreviation. The number in the FPB identification code associates it with a particular FPB recognition category. The FPB identification codes are developed as follows:

Barrier Abbreviation

- FC – FUEL CLAD
- RC – REACTOR COOLANT
- CT – CONTAINMENT

FPB Recognition Categories

- 1 – CRITICAL SAFETY FUNCTION STATUS
- 2 – CONTAINMENT RADIATION MONITORING
- 3 – CORE TEMPERATURE
- 4 – RCS LEVEL

- 5 – RCS LEAK RATE
- 6 – SG TUBE LEAKAGE / RUPTURE
- 7 – RCS ACTIVITY
- 8 – CONTAINMENT
- 9 – CONTAINMENT ISOLATION
- 10 – ED JUDGMENT

FPBs are treated the same as EALs in that they are applicable only as long as the condition(s) that meet or exceed their thresholds exist. This is in contrast to ECLs which once declared, remain in place until termination or recovery.

EALs and FPBs are predicated on UNPLANNED events. A planned evolution involves actions to address limitations imposed by the evolution, performance of surveillance testing, and implementation of controls prior to knowingly exceeding a threshold. Planned evolutions to test, manipulate, repair, perform maintenance or modifications to systems and equipment that will knowingly result in an EAL or FPB being met or exceeded are not subject to event declaration as long as the planned actions or compensatory measures do not meet an ECL with regard to level of safety and the evolution proceeds as planned.

All EALs and FPBs assume VALID indications, reports or conditions.

For EALs that contain time imbedded criterion, the EMERGENCY DIRECTOR should not wait until the applicable time period has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

Operating Mode Applicability

For purposes of event classification, the following operating mode applicability definitions establish the conditions when the EAL or FPB thresholds represent a threat:

Mode[a]	Reactivity Condition, Keff	% Rated Thermal Power[a]	Average Coolant Temperature
1) Power Operation	≥ 0.99	> 5%	N/A
2) Startup	≥ 0.99	≤ 5%	N/A
3) Hot Standby	< 0.99	N/A	≥ 350° F
4) Hot Shutdown[b]	< 0.99	N/A	350° F > T_{avg} > 200° F
5) Cold Shutdown[b]	< 0.99	N/A	≤ 200° F
6) Refueling	One or more reactor vessel head closure bolts less than fully tensioned.		
D) Defueled	All reactor fuel removed from reactor pressure vessel (full core off load during refueling or extended outage).		

(a) Excluding decay heat.

(b) All reactor vessel head closure bolts fully tensioned.

The plant operating mode that existed at the time the event occurred, prior to any protective system or operator action initiated in response to the condition, is compared to the IC/EAL mode applicability.

If an event occurs, and a lower or higher plant operating mode is reached before the EMERGENCY CLASSIFICATION LEVEL can be declared, the EMERGENCY CLASSIFICATION LEVEL shall be based on the mode that existed at the time the event occurred.

For events that occur in Cold Shutdown or Refueling, escalation is via EALs that have Cold Shutdown or Refueling for mode applicability, even if Hot Shutdown (or a higher mode) is entered during any subsequent heat-up. In particular, the FPB threshold values are applicable only to events that initiate in Hot Shutdown or higher.

Gaseous Effluent Flowpaths

NEI 99-01 Rev 5, AG1/AS1 technical bases criterion that states:

The site specific monitor list in EAL #1 should include effluent monitors on all potential release pathways.

½-ODC-2.02, Attachment P, BVPS-1 and BVPS-2 Gaseous Effluent Release Points provides a table for the initial basis in determining the list of effluent pathways that could be a source for radioactive release in an emergency. The ½-ODC-2.02, Attachment P, gaseous effluent release point descriptions are as follows:

	Unit 1	Unit 2
PROCESS VENT*	X	X
Containment/SLCRS Vent	X	X
Ventilation Vent	X	X
Condensate Polishing Building Vent		X
Waste Gas Storage Vault Vent		X
Decontamination Building Vent		X
Turbine Building Vent		X

* The PROCESS VENT is common to both Units 1 and 2 and is located at the top of the BVPS-1 cooling tower.

The BVPS-1 monitored effluent pathways SLCRS Vent and Ventilation Vent are considered the only potential monitored release path for accident conditions based on the following:

- Auxiliary Building ventilation is automatically diverted to the SLCRS for a Hi-Hi radiation alarm. The [Auxiliary] building exhaust is normally discharged to the atmosphere via the ventilation vent duct. A high-high alarm will cause the exhaust effluent to be diverted through a prefilter/charcoal/HEPA filter complex in the supplementary leak collection and release system before atmospheric discharge [UFSAR 11.3.3.3.5].
- On a containment isolation phase A signal or a high-high radiation signal from monitors in the ventilation exhausts from the fuel building, the waste gas storage area, or from areas contiguous to the containment with the exception of the main steam valve cubicle, the leak collection system exhaust is diverted so that it first flows through one of the two parallel main filter banks before flowing to the leak collection exhaust fans [UFSAR 6.6.2].
- The containment purge system isolation dampers are only open during plant shutdown. Containment can be purged via the Ventilation Vent, SLCRS Vent, or PROCESS VENT [ODCM]. Alignment to the low flow gaseous waste for release through the PROCESS VENT requires a discharge permit and use of RM-1VS-108A/B in accordance with 1OM-44C.4.A, Containment Purge Supply and Exhaust System Startup. A high-high activity alarm initiates automatic closure of valves downstream of the Gaseous Waste Gas Monitor [UFSAR 11.3.3.3.2], which is set at a fraction of the ODCM limit.

The Unit 1 SPING RM-1VS-110 effluent monitors are identified as the primary sampling locations for routine and emergency monitoring [1-HPP-4.02.002].

EAL Technical Basis Manual Content

Refer to Section 1.0 of the Emergency Preparedness Plan for a comprehensive list of definitions, abbreviations and acronyms that are used throughout the Emergency Plan.

EAL Matrix Table

The EAL Technical Basis Manual contains five EAL matrix tables, one for each of the different EAL recognition categories.

The EAL matrix is designed as an evaluation tool that organizes the ECLs from the highest (GENERAL EMERGENCY) on the left to the lowest (UNUSUAL EVENT) on the right. Evaluating the EALs for each ECL from highest to lowest reduces the possibility that an event will be under classified. All recognition categories are to be reviewed for applicability prior to event declaration.

Other user aids such as wallboards may be developed from the matrix table to support evaluation of abnormal conditions in other human factored formats.

EAL Documentation Format

Each EAL within the technical bases manual is documented in the following manner:

- IC Identification Number
- Initiating Condition
- Operating Mode Applicability
- EALs or FPB Threshold Value(s)
- Basis
    - Generic
    - Site Specific
- Basis Reference(s)

Beaver Valley Power Station Unit No. 1 (BVPS-1) to NEI 99-01, Revision 5
IC Cross Reference Tables

NEI to BVPS-1

NEI	BVPS-1	NEI	BVPS-1
FU1	FU1	SU1	SU1
FA1	FA1	SU2	SU5
FS1	FS1	SU3	SU4
FG1	FG1	SU4	SU9
		SU5	SU7
FC1	FC1	SU6	SU6
FC2	FC7	SU8	SU3
FC3	FC3	SA2	SA3
FC4	FC4	SA4	SA4
FC6	FC2	SA5	SA1
FC7	N/A	SS1	SS1
FC8	FC10	SS2	SS3
		SS3	SS2
RC1	RC1	SS6	SS4
RC2	RC5	SG1	SG1
RC4	RC6	SG2	SG3
RC6	RC2		
RC7	N/A	CU1	CU7
RC8	RC10	CU2	CU8
		CU3	CU1
CT1	CT1	CU4	CU10
CT2	CT8	CU6	CU6
CT3	CT3	CU7	CU2
CT4	CT6	CU8	CU3
CT5	CT9	CA1	CA7
CT6	CT2	CA3	CA1
CT7	N/A	CA4	CA10
CT8	CT10	CS1	CS7
		CG1	CG7
AU1	RU1		
AU2	RU2	HU1	HU3
AA1	RA1	HU2	HU4
AA2	RA2	HU3	HU5
AA3	RA3	HU4	HU1
AS1	RS1	HU5	HU6
AG1	RG1	HA1	HA3
		HA2	HA4
		HA3	HA5
		HA4	HA1
		HA5	HA2
		HA6	HA6
		HS2	HS2
		HS3	HS6
		HS4	HS1
		HG1	HG1
		HG2	HG6
		E-HU1	E-HU1

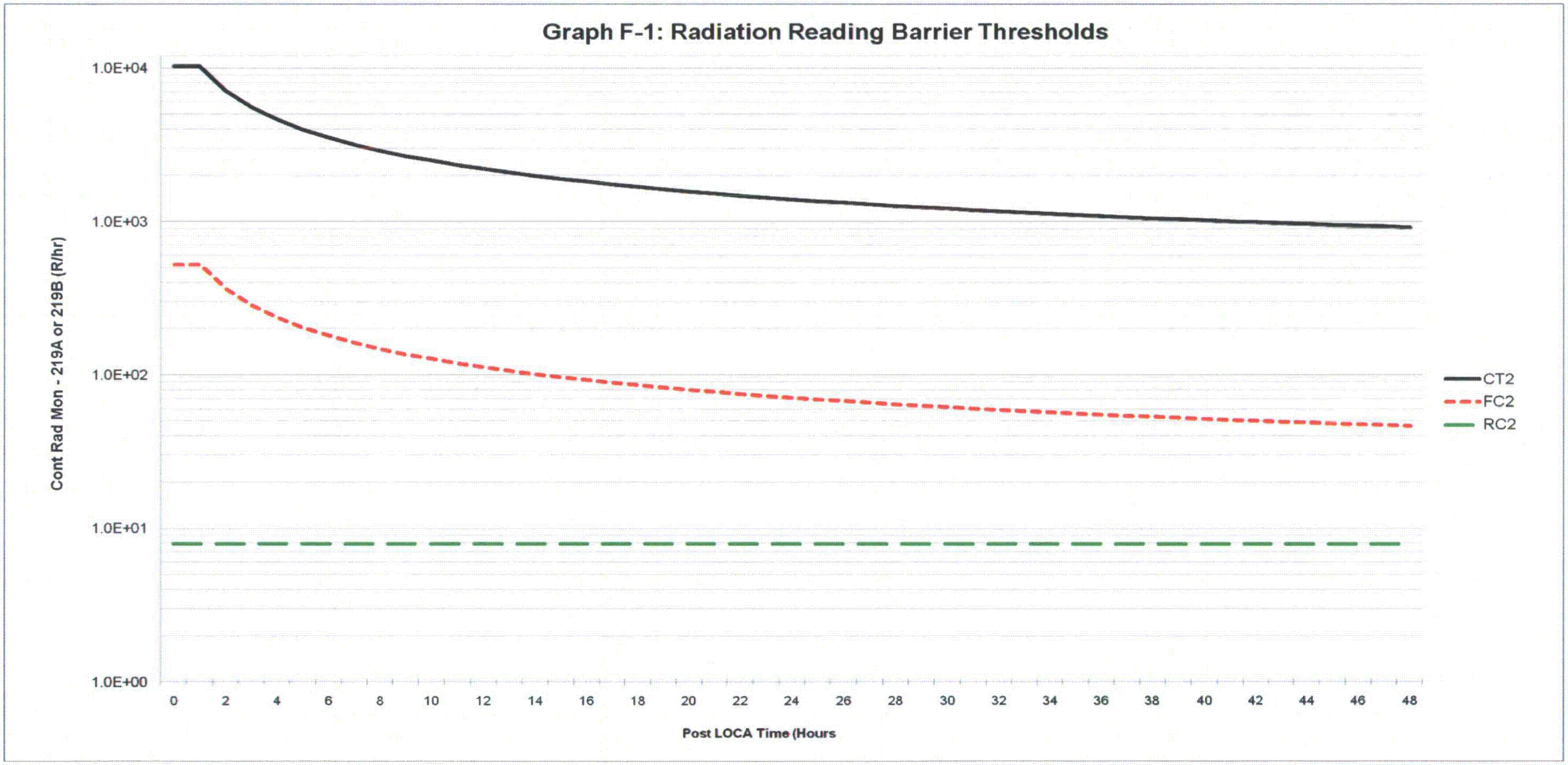
BVPS-1 to NEI

BVPS-1	NEI	BVPS-1	NEI
FG1	FG1	SG1	SG1
FS1	FS1	SS1	SS1
FA1	FA1	SA1	SA5
FU1	FU1	SU1	SU1
		SS2	SS3
FC1	FC1	SG3	SG2
FC2	FC6	SS3	SS2
FC3	FC3	SA3	SA2
FC4	FC4	SU3	SU8
FC7	FC2	SS4	SS6
N/A	FC7	SA4	SA4
FC10	FC8	SU4	SU3
		SU5	SU2
RC1	RC1	SU6	SU6
RC2	RC6	SU7	SU5
RC5	RC2	SU9	SU4
RC6	RC4		
N/A	RC7	CA1	CA3
RC10	RC8	CU1	CU3
		CU2	CU7
CT1	CT1	CU3	CU8
CT2	CT6	CU6	CU6
CT3	CT3	CG7	CG1
CT6	CT4	CS7	CS1
N/A	CT7	CA7	CA1
CT8	CT2	CU7	CU1
CT9	CT5	CU8	CU2
CT10	CT8	CA10	CA4
		CU10	CU4
RG1	AG1		
RS1	AS1	HG1	HG1
RA1	AA1	HS1	HS4
RU1	AU1	HA1	HA4
RA2	AA2	HU1	HU4
RU2	AU2	HS2	HS2
RA3	AA3	HA2	HA5
		HA3	HA1
		HU3	HU1
		HA4	HA2
		HU4	HU2
		HA5	HA3
		HU5	HU3
		HG6	HG2
		HS6	HS3
		HA6	HA6
		HU6	HU5
		E-HU1	E-HU1

FISSION PRODUCT BARRIER DEGRADATION

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
FG1 1 2 3 4 1. Loss of any two barriers and loss or potential loss of the third barrier.	**FS1** 1 2 3 4 1. Loss or potential loss of any two barriers.	**FA1** 1 2 3 4 1. Any loss or any potential loss of either fuel clad or RCS.	**FU1** 1 2 3 4 1. Any loss or any potential loss of containment.



* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

FISSION PRODUCT BARRIER DEGRADATION

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
FG1 1 2 3 4 1. Loss of any two barriers and loss or potential loss of the third barrier.	**FS1** 1 2 3 4 1. Loss or potential loss of any two barriers.	**FA1** 1 2 3 4 1. Any loss or any potential loss of either fuel clad or RCS.	**FU1** 1 2 3 4 1. Any loss or any potential loss of containment.

	FC – Fuel Clad		RC – Reactor Coolant System		CT - Containment	
Sub-Category	**Loss**	**Potential Loss**	**Loss**	**Potential Loss**	**Loss**	**Potential Loss**
1. Critical Safety Function Status	1. Core Cooling - Red entry conditions met.	1. Core Cooling - Orange entry conditions met. **OR** 2. a. Heat Sink - Red entry conditions met. **AND** b. Heat Sink is required.		1. RCS Integrity - Red entry conditions met. **OR** 2. a. Heat Sink - Red entry conditions met. **AND** b. Heat sink is required.		1. Containment - Red entry conditions met.
2. Containment Rad Monitoring	1. Containment Radiation Monitor (RM-1RM-219A or B) **> FC2 Line on Graph F-1**.		1. Containment Radiation Monitor (RM-1RM-219A or B) **> 8 R/hr (RC2 Line on Graph F-1)**.			1. Containment Radiation Monitor (RM-1RM-219A or B) **> CT2 Line on Graph F-1**.
3. Core Temperature	1. Five hottest core exit thermocouples **> 1200° F**.	1. Five hottest core exit thermocouples **> 719° F**.				1. a. Five hottest core exit thermocouples **> 2000° F**. **AND** b. Restoration procedures not effective within **15 minutes**. **OR** 2. a. Five hottest core exit thermocouples **> 1200° F**. **AND** b. RVLIS Full Range **< 40%** with no RCPs running. **AND** c. Restoration procedures not effective within **15 minutes**.
4. RCS Level		1. RCS level **< Table F-1**.				
5. RCS Leak Rate			1. RCS leak rate greater than available makeup capacity as indicated by RCS subcooling **< 18° normal containment** or **< 33° adverse containment**.	1. UNISOLABLE RCS leak exceeding the capacity of one charging pump (129 gpm) in the normal charging mode.		
6. SG Tube Leakage / Rupture			1. RUPTURED SG results in an SI actuation.		**Note:** A prolonged release is greater than 4 hours. 1. RUPTURED SG is also FAULTED outside of containment. **OR** 2. a. Primary-to-Secondary leak rate **> 10 gpm**. **AND**	

Table F-1: RVLIS Thresholds		
RVLIS	**RCPs**	**Indication**
Full Range	0	40%
Dynamic Range	1	25%
	2	33%
	3	60%

				b. UNISOLABLE prolonged steam release from affected SG to the environment.	

FISSION PRODUCT BARRIER DEGRADATION

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
FG1 1 2 3 4 1. Loss of any two barriers and loss or potential loss of the third barrier.	**FS1** 1 2 3 4 1. Loss or potential loss of any two barriers.	**FA1** 1 2 3 4 1. Any loss or any potential loss of either fuel clad or RCS.	**FU1** 1 2 3 4 1. Any loss or any potential loss of containment.

	FC – Fuel Clad		RC – Reactor Coolant System		CT – Containment	
Sub-Category	**Loss**	**Potential Loss**	**Loss**	**Potential Loss**	**Loss**	**Potential Loss**
7. RCS Activity	1. Coolant activity **> 300 µCi/gm** dose equivalent I-131.					
8. Containment Pressure					1. A containment pressure rise followed by a rapid UNPLANNED drop in containment pressure. **OR** 2. Containment pressure or sump level response not consistent with LOCA conditions.	1. Containment pressure **> 45 psig** and rising. **OR** 2. Containment hydrogen **> 4%**. **OR** 3. a. Containment pressure **> 11 psig**. **AND** b. Less than one full train of depressurization equipment operating.
9. Containment Isolation Failure					**Note:** Direct pathways include filtered pathways (e.g., SLCRS). 1. a. Failure of **ALL** valves in any one line to close. **AND** b. Direct downstream pathway to the environment exists after containment isolation signal.	
10. EMERGENCY DIRECTOR Judgment	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the fuel clad barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the fuel clad barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the RCS barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the RCS barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the containment barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the containment barrier.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

RADIOLOGICAL EFFLUENT / ABNORMAL RADIATION LEVELS

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

<table>
<tr><th></th><th>GENERAL EMERGENCY</th><th>SITE AREA EMERGENCY</th><th>ALERT</th><th>UNUSUAL EVENT</th></tr>
<tr><td>Radiological Effluent</td>
<td>RG1 1 2 3 4 5 6 D
OFFSITE dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology.
<u>EALs:</u>
Note:
If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results.
1. ANY of the following gaseous effluent monitors greater than the reading shown for 15 minutes* or longer:
• SLCRS Vent (RM-1VS-110 Ch 7)...... 7.66E+02 cpm
• Ventilation Vent (RM-1VS-109 Ch 7). 6.42E+02 cpm
OR
2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of EITHER of the following:
• > 1000 mRem TEDE.
• > 5000 mRem CDE Child Thyroid.
OR
3. Field survey results at or beyond the site boundary indicate EITHER of the following:
• Gamma (closed window) dose rate > 1000 mR/hr for 60 minutes* or longer.
• Air sample analysis > 5000 mRem CDE Child Thyroid for one hour of inhalation.</td>
<td>RS1 1 2 3 4 5 6 D
OFFSITE dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 100 mRem TEDE or 500 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology.
<u>EALs:</u>
Note:
If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results.
1. ANY of the following gaseous effluent monitors greater than the reading shown for 15 minutes* or longer:
• SLCRS Vent (RM-1VS-110 Ch 7)...... 7.66E+01 cpm
• Ventilation Vent (RM-1VS-109 Ch 7) . 6.42E+01 cpm
OR
2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of EITHER of the following:
• > 100 mRem TEDE.
• > 500 mRem CDE Child Thyroid.
OR
3. Field survey results at or beyond the site boundary indicate EITHER of the following:
• Gamma (closed window) dose rate > 100 mR/hr for 60 minutes* or longer.
• Air sample analysis > 500 mRem CDE Child Thyroid for one hour of inhalation.</td>
<td>RA1 1 2 3 4 5 6 D
Any release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM limit for 15 minutes* or longer.
<u>EALs:</u>
Note:
The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.
1. ANY of the following gaseous effluent monitors greater than the reading shown for 15 minutes or longer:
• SLCRS Vent (RM-1VS-110 Ch 5) ...... 6.76E+05 cpm
• Ventilation Vent (RM-1VS-109 Ch 5)..2.94E+05 cpm
OR
2. ANY of the following liquid effluent monitors > 200 times the High-High alarm setpoint, not to exceed 8.5E+05 cpm, established by a current radioactivity discharge permit for 15 minutes or longer:
• Liquid Waste Effluent Monitor (RM-1LW-104)
• Laundry and Contaminated Shower Drains Monitor (RM-1LW-116)
OR
3. Confirmed sample analysis for gaseous or liquid releases > 200 times the ODCM limit for 15 minutes or longer.</td>
<td>RU1 1 2 3 4 5 6 D
Any release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes* or longer.
<u>EALs:</u>
Note:
The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.
1. ANY of the following gaseous effluent monitors greater than the reading shown for 60 minutes or longer:
• SLCRS Vent (RM-1VS-110 Ch 5).......6.76E+03 cpm
• Ventilation Vent (RM-1VS-109 Ch 5)..2.94E+03 cpm
OR
2. ANY of the following liquid effluent monitors > 2 times the High-High alarm setpoint established by a current radioactivity discharge permit for 60 minutes or longer:
• Liquid Waste Effluent Monitor (RM-1LW-104)
• Laundry and Contaminated Shower Drains Monitor (RM-1LW-116)
OR
3. Confirmed sample analysis for gaseous or liquid releases > 2 times the ODCM limit for 60 minutes or longer.</td></tr>
<tr><td>Abnormal Radiation Levels</td>
<td></td>
<td></td>
<td>RA2 1 2 3 4 5 6 D
Damage to irradiated fuel or loss of water level that has resulted or will result in the uncovering of irradiated fuel outside the reactor vessel.
<u>EALs:</u>
1. A water level drop in the spent fuel pool, transfer canal or reactor cavity that will result in irradiated fuel becoming uncovered.
OR
2. > 1000 mR/hr reading on ANY of the following due to damage to irradiated fuel or loss of water level:
• Manipulator Crane Area Monitor (RM-1RM-203)
• Fuel Pool Bridge Area Monitor (RM-1RM-207)</td>
<td>RU2 1 2 3 4 5 6 D
UNPLANNED rise in plant radiation levels.
<u>EALs:</u>
1. a. UNPLANNED water level drop in the spent fuel pool, transfer canal or reactor cavity as indicated by level < Tech Spec Minimum (23 feet).
AND
b. Area radiation monitor rise resulting in a High-High alarm on ANY of the following:
• Manipulator Crane Area Monitor (RM-1RM-203)
• Fuel Pool Bridge Area Monitor (RM-1RM-207)
OR
2. UNPLANNED area radiation monitor or radiation survey > 1000 times NORMAL LEVELS.</td></tr>
</table>

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

RADIOLOGICAL EFFLUENT / ABNORMAL RADIATION LEVELS

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Abnormal Radiation Levels			**RA3** 1 2 3 4 5 6 D Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions. EALs: 1. Dose rate **> 15 mR/hr** in **ANY** of the following areas requiring continuous occupancy to maintain plant safety functions: • CONTROL ROOM • Central Alarm Station • Secondary Alarm Station	

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Security	**HG1** 1 2 3 4 5 6 D HOSTILE ACTION resulting in loss of physical control of the facility. EALs: 1. A HOSTILE ACTION has occurred such that plant personnel are unable to operate equipment required to maintain safety functions listed below: • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink) **OR** 2. A HOSTILE ACTION has caused failure of spent fuel cooling systems and IMMINENT fuel damage is likely.	**HS1** 1 2 3 4 5 6 D HOSTILE ACTION within the PROTECTED AREA. EALs: 1. A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the Security Shift Supervisor.	**HA1** 1 2 3 4 5 6 D HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat. EALs: 1. A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the Security Shift Supervisor. **OR** 2. A validated notification from the NRC of a LARGE AIRCRAFT attack threat within **30 minutes** of the site.	**HU1** 1 2 3 4 5 6 D Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant. EALs: 1. A SECURITY CONDITION that does not involve a HOSTILE ACTION as reported by the Security Shift Supervisor. **OR** 2. A credible site specific security threat notification. **OR** 3. A validated notification from the NRC providing information of a LARGE AIRCRAFT threat.
CR Evacuation		**HS2** 1 2 3 4 5 6 D CONTROL ROOM evacuation has been initiated and plant control cannot be established. EALs: 1. a. CONTROL ROOM evacuation has been initiated. **AND** b. Control of **ANY** of the following safety functions is not established from an alternate location within **15 minutes**. • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink)	**HA2** 1 2 3 4 5 6 D CONTROL ROOM evacuation has been initiated. EALs: 1. CONTROL ROOM evacuation has been initiated.	

• The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT

Natural or Destructive Phenomena

Table H-1
• Cable Tunnel (CV-3)
• CONTROL ROOM
• Containment Building
• Demin. Water Storage Tank (1WT-TK-10)
• Diesel Generator Building
• Fuel Building
• Intake Structure Pump Cubicles
• Safeguards (including AFW, Main Steam and Cable Vault Areas)
• Primary Auxiliary Building (except elev. 768')
• RWST (1QS-TK-1)
• Service Building (below elev. 735')

ALERT

HA3 1 2 3 4 5 6 D

Natural or destructive phenomena affecting VITAL AREAS.

EALs:

1. a. Seismic event **> 0.06g (OBE)** acceleration (as indicated by analysis of the **Accelerograph Recording System** or lit lamp on 2ERS-CCC-1 Seismic Instrumentation Central Control Cabinet).

   AND

   b. Earthquake confirmed by **ANY** of the following:
   - Earthquake felt in plant.
   - National Earthquake Center.
   - CONTROL ROOM indication of degraded performance of systems required for the safe shutdown of the plant.

   OR

2. Tornado or high winds **> 80 mph** resulting in **EITHER** of the following:
   - VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

   OR

3. Internal flooding in **Table H-1** areas resulting in **EITHER** of the following:
   - Electrical shock hazard that precludes access to operate or monitor safety equipment.
   - CONTROL ROOM indication of degraded performance of those safety systems.

   OR

4. High river level **> 705 feet MSL** resulting in **EITHER** of the following:
   - VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

   OR

5. Low river level (LR-1CW-101) **< 650 feet MSL** resulting in CONTROL ROOM indication of degraded performance of safety systems located in **Table H-1** areas.

   OR

6. Turbine failure-generated PROJECTILES resulting in **EITHER** of the following:
   - VISIBLE DAMAGE to or penetration of **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

UNUSUAL EVENT

HU3 1 2 3 4 5 6 D

Natural or destructive phenomena affecting the PROTECTED AREA.

EALs:

1. a. Seismic event **> 0.01g** acceleration (as indicated by initiation of the **Accelerograph Recording System** on A11-59, Seismic Accelerograph Operation).

   AND

   b. Earthquake confirmed by **EITHER** of the following:
   - Earthquake felt in plant.
   - National Earthquake Center.

   OR

2. a. Tornado within the PROTECTED AREA.

   OR

   b. High winds **> 80 mph**.

   OR

3. Internal flooding in **Table H-1** areas that has the potential to affect safety related equipment required by Technical Specifications for the current operating mode.

   OR

4. High river water level **> 705 feet MSL**.

   OR

5. Low river water level (LR-1CW-101) **< 650 feet MSL**.

   OR

6. Turbine failure resulting in casing penetration or damage to turbine or generator seals.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

		OR 7. Vehicle crash resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems.	

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
FIRE / EXPLOSION	**Table H-1** • Cable Tunnel (CV-3) • CONTROL ROOM • Containment Building • Demin. Water Storage Tank (1WT-TK-10) • Diesel Generator Building • Fuel Building • Intake Structure Pump Cubicles • Safeguards (including AFW, Main Steam and Cable Vault Areas) • Primary Auxiliary Building (except elev. 768') • RWST (1QS-TK-1) • Service Building (below elev. 735')		**HA4** 1 2 3 4 5 6 D FIRE or EXPLOSION affecting the operability of plant safety systems required to establish or maintain safe shutdown. **EALs:** 1. FIRE or EXPLOSION resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems.	**HU4** 1 2 3 4 5 6 D FIRE within the PROTECTED AREA not extinguished within 15 minutes of detection or EXPLOSION within the PROTECTED AREA. **EALs:** **Note:** Immediately adjacent to applies to FIRES that directly impact or obstruct the areas of concern. 1. FIRE not extinguished within **15 minutes*** of CONTROL ROOM notification or verification of a CONTROL ROOM FIRE alarm in actual contact with or immediately adjacent to **ANY** of the **Table H-1** areas. **OR** 2. EXPLOSION within the PROTECTED AREA.
Toxic Gas			**HA5** 1 2 3 4 5 6 D Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of operable equipment required to maintain safe operations or safely shutdown the reactor. **EALs:** **Notes:** • If the equipment in the stated area was already inoperable, or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event. • This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area. 1. Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of systems required to maintain safe operations or safely shutdown the reactor.	**HU5** 1 2 3 4 5 6 D Release of toxic, corrosive, asphyxiant or flammable gases deemed detrimental to NORMAL PLANT OPERATIONS. **EALs:** **Note:** This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area. 1. Toxic, corrosive, asphyxiant or flammable gases in amounts that have or could adversely affect NORMAL PLANT OPERATIONS. **OR** 2. Report by local, county or state officials for evacuation or sheltering of site personnel based on an OFFSITE event.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the duration has exceeded, or will likely exceed, the applicable time.

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
EMERGENCY DIRECTOR Judgment	**HG6** 1 2 3 4 5 6 D Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of GENERAL EMERGENCY. **EALs:** 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PROTECTIVE ACTION GUIDE exposure levels OFFSITE for more than the immediate site area.	**HS6** 1 2 3 4 5 6 D Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of SITE AREA EMERGENCY. **EALs:** 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts: (1) toward site personnel or equipment that could lead to the likely failure of or, (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PROTECTIVE ACTION GUIDE exposure levels beyond the site boundary.	**HA6** 1 2 3 4 5 6 D Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an ALERT. **EALs:** 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA PROTECTIVE ACTION GUIDE exposure levels.	**HU6** 1 2 3 4 5 6 D Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an UNUSUAL EVENT. **EALs:** 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring OFFSITE response or monitoring are expected unless further degradation of safety systems occurs.
DFSF				**E-HU1** Not Applicable Damage to a loaded cask CONFINEMENT BOUNDARY. **EALs:** 1. Damage to a loaded cask CONFINEMENT BOUNDARY.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

SYSTEM MALFUNCTIONS - HOT

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Loss of AC Power	**SG1** [1][2][3][4] Prolonged loss of all OFFSITE and all ONSITE AC power to emergency busses. EALs: 1. a. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses. **AND** b. **EITHER** of the following: • Restoration of **EITHER** the AE 4KV emergency bus **OR** DF 4KV emergency bus within **4 hours** is not likely. • Core Cooling - Red entry conditions met.	**SS1** [1][2][3][4] Loss of all OFFSITE and all ONSITE AC power to emergency busses for 15 minutes or longer. EALs: **Note:** Credit cannot be taken for emergency busses being powered from the other unit's emergency diesel generators. 1. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes*** or longer.	**SA1** [1][2][3][4] AC power capability to emergency busses reduced to a single source for 15 minutes or longer. EALs: 1. a. AC power to AE and DF 4KV emergency busses is reduced to a single power source for **15 minutes*** or longer. **AND** b. Any additional single power source failure will result in loss of **ALL** AC power to **BOTH** AE and DF 4KV emergency busses.	**SU1** [1][2][3][4] Loss of all OFFSITE AC power to emergency busses for 15 minutes or longer. EALs: 1. Loss of **ALL** OFFSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes*** or longer.
Loss of DC Power		**SS2** [1][2][3][4] Loss of all vital DC power for 15 minutes or longer. EALs: 1. Bus voltage indication on **ALL** safety related DC busses less than the following for **15 minutes*** or longer: • **< 110.4 VDC** on Busses 1-1 and 1-2 • **< 110.0 VDC** on Busses 1-3 and 1-4		
Failure of RPS	**SG3** [1][2] Automatic trip and all manual actions failed to shutdown the reactor and indication of an extreme challenge to the ability to cool the core exists. EALs: 1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power **> 5%**. **AND** b. **ALL** manual trip actions failed to shutdown the reactor as indicated by reactor power **> 5%**. **AND** c. **EITHER** of the following has occurred: • Core Cooling - Red entry conditions met. • Heat Sink - Red entry conditions met.	**SS3** [1][2] Automatic trip and manual actions taken within the Controls Area (CA) failed to shutdown the reactor. EALs: 1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power **> 5%**. **AND** b. Manual trip actions taken within the Controls Area (CA) failed to shutdown the reactor as indicated by reactor power **> 5%**.	**SA3** [1][2] Automatic trip failed to shutdown the reactor and the manual actions taken from the Controls Area (CA) are successful in shutting down the reactor. EALs: 1. a. An automatic reactor trip failed to shutdown the reactor. **AND** b. Manual trip actions taken within the Controls Area (CA) successfully shutdown the reactor as indicated by reactor power **≤ 5%**.	**SU3** [3][4] Inadvertent criticality. EALs: 1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the duration has exceeded, or will likely exceed, the applicable time.

SYSTEM MALFUNCTIONS - HOT

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Annunciators	**Table S-1: Critical Safety Functions** • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink) **Table S-2: Significant Transients** • Automatic turbine runback > 25% thermal power • Electrical load rejection > 25% full electrical load • Reactor trip • Safety Injection actuation	**SS4** 1 2 3 4 Inability to monitor a significant transient in progress. EALs: 1. a. Loss of > **75%** of **EITHER** of the following for **15 minutes*** or longer: • CONTROL ROOM Annunciator Panels (A1 - A13). OR • CONTROL ROOM critical safety function indications (Table S-1). **AND** b. A **Table S-2** significant transient is in progress. **AND** c. COMPENSATORY INDICATIONS are unavailable.	**SA4** 1 2 3 4 Loss of safety system annunciation or indication in the CONTROL ROOM with either: (1) a significant transient in progress, or (2) COMPENSATORY INDICATIONS are unavailable. EALs: 1. a. Loss of > **75%** of **EITHER** of the following for **15 minutes*** or longer: • CONTROL ROOM Annunciator Panels (A1 - A13). **OR** • CONTROL ROOM critical safety function indications (Table S-1). **AND** b. **EITHER** of the following: • A **Table S-2** significant transient is in progress. **OR** • COMPENSATORY INDICATIONS are unavailable.	**SU4** 1 2 3 4 Loss of safety system annunciation or indication in the CONTROL ROOM for 15 minutes or longer. EALs: 1. Loss of > **75%** of **EITHER** the following for **15 minutes*** or longer: • CONTROL ROOM Annunciator Panels (A1 - A13). **OR** • CONTROL ROOM critical safety function indications (Table S-1).
T.S. Limits				**SU5** 1 2 3 4 Inability to reach required operating mode within Technical Specification limits. EALs: 1. Plant is not brought to required operating mode within Technical Specification LCO action statement time.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the duration has exceeded, or will likely exceed, the applicable time.

SYSTEM MALFUNCTIONS - HOT

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Communications				**SU6** 1 2 3 4 Loss of all ONSITE or OFFSITE communications capabilities. **EALs:** 1. Loss of **ALL** of the following ONSITE communication methods affecting the ability to perform routine operations: • Radios. • Plant page. • Plant telephone system (hardwired). **OR** 2. Loss of **ALL** of the following OFFSITE communications methods affecting the ability to perform OFFSITE notifications: • NRC Emergency Notification System – ENS (Red Phone). • NRC Health Physics Network – HPN. • Commercial telephones (hardwired and wireless).
RCS Leakage				**SU7** 1 2 3 4 RCS leakage. **EALs:** Note: • Identified, unidentified and pressure boundary RCS leakage as defined by Technical Specifications. • Relief valve normal operation should be excluded unless it fails to close and cannot be isolated. 1. Unidentified or pressure boundary leakage **> 10 gpm**. **OR** 2. *Identified leakage* **> 25 gpm**.
Fuel Clad Degradation				**SU9** 1 2 3 4 Fuel clad degradation. **EALs:** 1. Letdown Monitor (RM-1CH-101A or B) **> 6.0E+04 cpm**. **OR** 2. RCS activity > 21 µCi/gm dose equivalent I-131.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

SYSTEM MALFUNCTIONS - COLD

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Loss of AC Power			**CA1** 5 6 D Loss of all OFFSITE and all ONSITE AC power to emergency busses for 15 minutes or longer. **EALs:** 1. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes*** or longer.	**CU1** 5 6 AC power capability to emergency busses reduced to a single source for 15 minutes or longer. **EALs:** 1. a. AC power to AE and DF 4KV emergency busses is reduced to a single source for **15 minutes*** or longer. **AND** b. Any additional single power source failure will result in loss of **ALL** AC power to **BOTH** AE and DF 4KV emergency busses.
Loss of DC Power				**CU2** 5 6 Loss of required DC power for 15 minutes or longer. **EALs:** 1. Bus voltage indication on the **required** DC busses less than the following for **15 minutes*** or longer: • **< 110.4 VDC** on Bus 1-1 or Bus 1-2 • **< 110.0 VDC** on Bus 1-3 or Bus 1-4
Failure of RPS				**CU3** 5 6 Inadvertent criticality. **EALs:** 1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.
Communications				**CU6** 5 6 D Loss of all ONSITE or OFFSITE communications capabilities. **EALs:** 1. Loss of **ALL** of the following ONSITE communication methods affecting the ability to perform routine operations: • Radios. • Plant page. • Plant telephone system (hardwired). **OR** 2. Loss of **ALL** of the following OFFSITE communications methods affecting the ability to perform OFFSITE notifications: • NRC Emergency Notification System – ENS (Red Phone). • NRC Health Physics Network – HPN. • Commercial telephones (hardwired and wireless).

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

SYSTEM MALFUNCTIONS - COLD

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
RCS Leakage	**CG7** 5 6 Loss of RCS inventory affecting fuel clad integrity with containment challenged. __EALs:__ 1. a. RCS level **< 56%** RVLIS Full Range (top of active fuel) for **30 minutes*** or longer. **AND** b. **ANY Table C-1** containment challenge indications. **OR** 2. a. RCS level cannot be monitored with core uncovery for **30 minutes*** or longer. **AND** b. Loss of RCS inventory as indicated by **ANY** of the following: • Containment Radiation Monitor (RM-1RM-219A or B) **> 15 R/hr**. • Erratic source range monitor indication. • UNPLANNED level rise in Containment sumps or incore instrument sump. **AND** c. **ANY Table C-1** containment challenge indications. **Table C-1: Containment Challenge Indications** • CONTAINMENT CLOSURE not established. • Hydrogen concentration > 4% inside containment. • UNPLANNED rise in containment pressure.	**CS7** 5 6 Loss of RCS inventory affecting core decay heat removal capability. __EALs:__ 1. a. CONTAINMENT CLOSURE not established. **AND** b. RCS level **< 64%** RVLIS Full Range (6" below bottom of hot leg). **OR** 2. a. CONTAINMENT CLOSURE established. **AND** b. RCS level **< 56%** RVLIS Full Range (top of active fuel). **OR** 3. a. RCS level cannot be monitored for **30 minutes*** or longer. **AND** b. Loss of RCS inventory as indicated by **ANY** of the following: • Containment Radiation Monitor (RM-1RM-219A or B) **> 15 R/hr**. • Erratic source range monitor indication. • UNPLANNED level rise in Containment sumps or incore instrument sump.	**CA7** 5 6 Loss of RCS inventory. __EALs:__ 1. Loss of RCS inventory as indicated by **ANY** of the following: • RVLIS Full Range Level (LT-1RC-1311) **< 65%** (bottom of hot leg). • Refueling Outage Temporary Level Instrument (LI-1RC-481C) **< 16 inches** (Reduced Inventory Only). • Refueling Outage Temporary Level Instrument (LI-1RC-482C) **< 6 inches** (Midloop Only). **OR** 2. a. RCS level cannot be monitored for **15 minutes*** or longer. **AND** b. Loss of RCS inventory as indicated by UNPLANNED level rise in Containment sumps or incore instrument sump.	**CU7** 5 RCS leakage. __EALs:__ **Note:** Relief valve normal operation should be excluded unless it fails to close and cannot be isolated. 1. RCS leakage results in the inability to maintain or restore RCS level **> Target Level Band** for **15 minutes*** or longer. **CU8** 6 UNPLANNED loss of RCS inventory. __EALs:__ 1. UNPLANNED RCS level drop as indicated by **EITHER** of the following: • Refueling Outage Temporary Level Instrument (L-1RC-481C) **< 97 inches** (vessel flange) for **15 minutes*** or longer when the RCS level band is established __**above**__ the vessel flange. **OR** • RCS water level drop below the RCS level band for **15 minutes*** or longer when the RCS level band is established __**below**__ the vessel flange. **OR** 2. a. RCS level cannot be monitored. **AND** b. Loss of RCS inventory as indicated by UNPLANNED level rise in containment sumps or incore instrument sump.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

SYSTEM MALFUNCTIONS - COLD

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
RCS Leakage			**CA10** [5][6] Inability to maintain plant in cold shutdown. **EALs:** **Note:** Full inventory is pressurizer level ≥ 22% actual with loop stops either isolated or unisolated. 1. RCS temperature **> 200° F** due to an UNPLANNED loss of decay heat removal capability for the greater than the specified duration on **Table C-2**. **OR** 2. a. RCS temperature cannot be monitored. **AND** b. RCS pressure rise **> 10 psi** due to an UNPLANNED loss of decay heat removal capability (this EAL does not apply in RCS solid plant conditions).	**CU10** [5][6] UNPLANNED Loss of decay heat removal capability. **EALs:** 1. RCS temperature **> 200° F** due to an UNPLANNED loss of decay heat removal capability. **OR** 2. Loss of **ALL** RCS temperature and RCS level indication for **15 minutes*** or longer.

Table C-2: RCS Reheat Duration Thresholds

RCS	Cont Closure	Duration
Intact with Full RCS Inventory	N/A	> 60 min**
Not Intact **OR** Not Full RCS Inventory	Established	> 20 min**
	Not Established	0 min

** If an RCS heat removal system is in operation within this time frame and RCS temperature is being reduced, this EAL is not applicable.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

FG1

INITIATING CONDITION:

Loss of any two barriers and loss or potential loss of the third barrier.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Refer to fission product barrier loss and potential loss threshold values to determine barrier status.

Basis:

Generic

Fuel cladding, RCS and containment comprise the fission product barriers.

At the GENERAL EMERGENCY CLASSIFICATION LEVEL each barrier is weighted equally.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Tables 5-F-1 and 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

FS1

INITIATING CONDITION:

Loss or potential loss of any two barriers.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Refer to fission product barrier loss and potential loss threshold values to determine barrier status.

Basis:

Generic

Fuel cladding, RCS and containment comprise the fission product barriers.

At the SITE AREA EMERGENCY CLASSIFICATION LEVEL, each barrier is weighted equally.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Tables 5-F-1 and 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

FA1

INITIATING CONDITION:

Any loss or any potential loss of either fuel clad or RCS.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Refer to fission product barrier loss and potential loss threshold values to determine barrier status.

Basis:

Generic

Fuel cladding, RCS and containment comprise the fission product barriers.

The fuel cladding and RCS barriers are weighted more heavily than the containment barrier. Unlike the containment barrier, loss or potential loss of either the fuel cladding or RCS barrier may result in the relocation of radioactive materials or degradation of core cooling capability. Note that the loss or potential loss of containment barrier in combination with loss or potential loss of either fuel cladding or RCS barrier results in declaration of a SITE AREA EMERGENCY under FS1.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Tables 5-F-1 and 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

FU1

INITIATING CONDITION:

Any loss or any potential loss of containment.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Refer to fission product barrier loss and potential loss threshold values to determine barrier status.

Basis:

Generic

Fuel cladding, RCS and containment comprise the fission product barriers.

Unlike the Fuel cladding and RCS barriers, the loss of either of which results in an ALERT under FA1, loss of the containment barrier in and of itself does not result in the relocation of radioactive materials or the potential for degradation of core cooling capability. However, loss or potential loss of the containment barrier in combination with the loss or potential loss of either the fuel cladding or RCS barrier results in declaration of a SITE AREA EMERGENCY under FS1.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Tables 5-F-1 and 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Critical Safety Function Status **FC1**

Loss:

1. Core Cooling - Red entry conditions met.

Potential Loss:

1. Core Cooling - Orange entry conditions met.

   OR

2. a. Heat Sink - Red entry conditions met.

      AND

   b. Heat Sink is required.

Basis:

Generic

Loss Threshold #1

Core Cooling - Red indicates significant superheating and core uncovery and is considered to indicate loss of the Fuel Clad Barrier.

Potential Loss Threshold #1

Core Cooling - Orange indicates subcooling has been lost and that some clad damage may occur.

Potential Loss Threshold #2

Heat Sink - Red when heat sink is required indicates the ultimate heat sink function is under extreme challenge.

Site Specific

Potential Loss Threshold #2

The condition "Heat Sink is required" was added to preclude over-classification for conditions in which RCS pressure is less than steam generator pressure or Heat Sink-Red path entry was created by intentional operator action directed by the EMERGENCY OPERATING PROCEDURE.

Basis Reference(s):

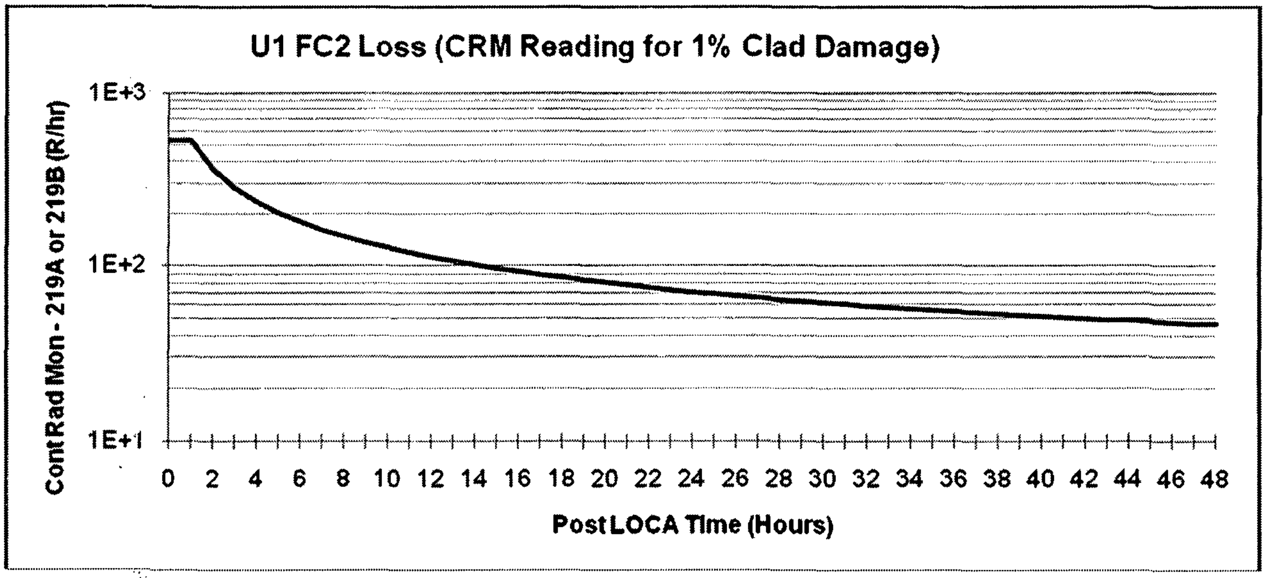
1. NEI 99-01 Rev 5, Table 5-F-3
2. FR-H.1, Loss of Heat Sink

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Containment Radiation Monitoring **FC2**

Loss:

1. Containment Radiation Monitor (RM-1RM-219A or B) > **FC2 Line on Graph F-1.**



Potential Loss:

None

Basis:

Generic

The site specific reading is a value which indicates the release of reactor coolant, with elevated activity indicative of fuel damage, into the containment.

The reading should be calculated assuming the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with a concentration of 300 μCi/gm dose equivalent I-131 into the containment atmosphere.

Reactor coolant concentrations of this magnitude are several times larger than the maximum concentrations (including iodine spiking) allowed within Technical Specifications and are therefore indicative of fuel damage.

This value is higher than that specified for RC2(L)1. Thus, this threshold indicates a loss of both the Fuel Clad barrier and RCS barrier that appropriately escalates the emergency classification to a SITE AREA EMERGENCY.

There is no potential loss threshold associated with this item.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

FC2 (continued)

Site Specific

An RCS activity of 300 μCi/gm dose equivalent I-131 is equivalent to 1% fuel clad gap damage per ERS-SMM-11-002, Rev 0.

The containment radiation monitor readings specified in Graph F-1 were derived using 1% clad damage. The CRM values for the 0 to 1 hour period are set at the 1 hour value for ease of use.

FC2: CRM Readings (R/Hr)

Hrs	RM-1RM-219A or B
0	5.2E+02
1	5.2E+02
2	3.6E+02
3	2.8E+02
4	2.4E+02
5	2.0E+02
6	1.8E+02
7	1.6E+02
8	1.5E+02
12	1.1E+02
16	9.3E+01
20	8.0E+01
24	7.1E+01
28	6.4E+01
32	5.9E+01
36	5.5E+01
40	5.2E+01
44	4.9E+01
48	4.6E+01

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. ERS-SMM-11-002, Containment Radiation Monitor Readings Following Clad Damage (FC2 Loss, FC7 Loss, RC2 Loss and CT2 Potential Loss), Rev 0

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Core Temperature **FC3**

Loss:

1. Five hottest core exit thermocouples **> 1200° F**.

Potential Loss:

1. Five hottest core exit thermocouples **> 719° F**.

Basis:

Generic

Loss Threshold #1

The site-specific reading should correspond to significant superheating of the coolant.

This value typically corresponds to the core exit temperature reading that indicates core cooling – Red in Fuel Clad Barrier loss threshold, which is usually about 1200° F.

Potential Loss Threshold #1

The site specific reading should correspond to loss of subcooling.

This value typically corresponds to the core exit temperature reading that indicates core cooling – Orange in fuel clad barrier potential loss threshold, which is usually about 700° to 900° F.

Site Specific

Potential Loss Threshold #1

The U1 CONTROL ROOM Post Accident Monitoring (PAM), Inadequate Core Cooling Monitor (ICCM) displays the five (5) hottest core exit thermocouples.

The value of 719° F was established from 1OM-53B.4.F-0.2 as equivalent to Orange Path in the Core Cooling Critical Safety Function Status Tree per FR-C.1 and FR-C.2.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. 1OM-53B.4.F-0.2 (ISS1C), Core Cooling Status Trees, Rev 1
3. FR-C.1, Inadequate Core Cooling
4. FR-C.2, Degraded Core Cooling

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

RCS Level **FC4**

Loss:

None

Potential Loss:

1. RCS level < **Table F-1**.

Table F-1: RVLIS Thresholds		
RVLIS	**RCPs**	**Indication**
Full Range	0	40%
Dynamic Range	1	25%
	2	33%
	3	60%

Basis:

Generic

There is no loss threshold associated with this item.

The site specific value for the potential loss threshold corresponds to the top of the active fuel.

For sites using CSFSTs, the potential loss threshold is defined by the Core Cooling - Orange path. The site specific value in this threshold should be consistent with the CSFST value.

Site Specific

Beaver Valley used CSFSTs. Therefore, the Orange Path includes Dynamic Range with RCPs running.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. 1OM-53A.1.F-0.2 (ISS1C), Core Cooling Status Trees, Rev 1
3. FR-C.2, Degraded Core Cooling

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

RCS Activity **FC7**

Loss:

1. Coolant activity **> 300 μCi/gm** dose equivalent I-131.

Potential Loss:

None

Basis:

Generic

The site specific value corresponds to 300 μCi/gm I-131 equivalent. Assessment by the EAL Task Force indicates that this amount of coolant activity is well above that expected for iodine spikes and corresponds to less than 5% fuel clad damage. This amount of radioactivity indicates significant clad damage and thus the fuel clad barrier is considered lost.

The results of the sample analysis are expressed as μCi/gm I-131 equivalent.

There is no potential loss threshold associated with this item.

Site Specific

An RCS activity of >300 μCi/gm is above the technical specification limits of 0.35 μCi/gm DEI-131 for steady state and 21 μCi/gm DEI-131 for iodine spiking.

An RCS activity of 300 μCi/gm dose equivalent I-131 is equivalent to 1% fuel clad gap damage per ERS-SMM-11-002, Rev 0.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. BVPS-1&2 Technical Specification 3.4.16, RCS Specific Activity
3. ERS-SMM-11-002, Containment Radiation Monitor Readings Following Clad Damage (FC2 Loss, FC7 Loss, RC2 Loss and CT2 Potential Loss), Rev 0

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

EMERGENCY DIRECTOR Judgment **FC10**

Loss:

1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the fuel clad barrier.

Potential Loss:

1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the fuel clad barrier.

Basis:

Generic

These thresholds address any other factors that are to be used by the EMERGENCY DIRECTOR in determining whether the fuel clad barrier is lost or potentially lost. In addition, the inability to monitor the barrier should also be incorporated in this EAL as a factor in EMERGENCY DIRECTOR judgment that the barrier may be considered lost or potentially lost.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Critical Safety Function Status **RC1**

Loss:

None

Potential Loss:

1. RCS Integrity - Red entry conditions met.

   OR

2. a. Heat Sink - Red entry conditions met.

   AND

   b. Heat Sink is required.

Basis:

Generic

There is no loss threshold associated with this item.

Potential Loss Threshold #1

RCS Integrity - Red indicates an extreme challenge to the safety function derived from appropriate instrument readings.

Potential Loss Threshold #2

Heat Sink - Red when heat sink is required indicates the ultimate heat sink function is under extreme challenge.

Site Specific

Potential Loss Threshold #2

The conditional statement was included to allow for the use of available cooling methods within the EOP when determining that the heat sink function was lost or severely degraded when needed. The heat sink function is not considered lost until the EOP methods for temperature control are shown to be unsuccessful.

The condition "Heat Sink is required" was added to preclude over-classification for conditions in which RCS pressure is less than steam generator pressure or Heat Sink-Red path entry was created by intentional operator action directed by the EMERGENCY OPERATING PROCEDURE.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. FR-P.1, Pressurized Thermal Shock
3. FR-H.1, Loss of Heat Sink

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Containment Radiation Monitoring **RC2**

Loss:

1. Containment Radiation Monitor (RM-1RM-219A or B) **> 8 R/hr (RC2 Line on Graph F-1).**

Potential Loss:

None

Basis:

Generic

The site specific reading is a value which indicates the release of reactor coolant to the containment.

The reading should be calculated assuming the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with normal operating concentrations (i.e., within technical specifications) into the containment atmosphere.

This reading will be less than that specified for FC2(L)1. Thus, this threshold would be indicative of a RCS leak only. If the radiation monitor reading increased to that specified by fuel clad barrier threshold, fuel damage would also be indicated.

There is no potential loss threshold associated with this item.

Site Specific

Technical Specification 3.4.16 analyses are for two cases of RCS activity. The RC2 threshold value is based on the higher RCS TS activity of 21 μCi/gm dose equivalent I-131 to provide an on scale containment radiation monitor reading. A containment monitor reading less than the threshold value would relate to normal RCS (no core damage) activity within technical specifications.

The RM-1RM-219 A/B calculated EAL value of 7.9 R/hr has been rounded to 8 R/hr based on accuracy of the analog instrument display capability. 8 R/hr is the closest visually distinguishable reading to the derived EAL value. Instrument markings that bound the calculated EAL value are 6 and 8 R/hr.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. BVPS-1&2 Technical Specifications Section 3.4.16, RCS Specific Activity
3. ERS-SMM-11-002, Containment Radiation Monitor Readings Following Clad Damage (FC2 Loss, FC7 Loss, RC2 Loss and CT2 Potential Loss), Rev 0

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

RCS Leak Rate **RC5**

Loss:

1. RCS leak rate greater than available makeup capacity as indicated by RCS subcooling **< 18° normal containment** or **< 33° adverse containment.**

Potential Loss:

1. UNISOLABLE RCS leak exceeding the capacity of one charging pump (129 gpm) in the normal charging mode.

Basis:

Generic

Loss Threshold #1

This threshold addresses conditions where leakage from the RCS is greater than available inventory control capacity such that a loss of subcooling has occurred. The loss of subcooling is the fundamental indication that the inventory control systems are inadequate in maintaining RCS pressure and inventory against the mass loss through the leak.

Potential Loss Threshold #1

This threshold is based on the apparent inability to maintain normal liquid inventory within the Reactor Coolant System (RCS) by normal operation of the Chemical and Volume Control System which is considered to be the flow rate equivalent to one charging/makeup pump discharging to the charging header. Isolating letdown is a standard abnormal operating procedure action and may prevent unnecessary classifications when a non-RCS leakage path such as a CVCS leak exists. The intent of this condition is met if attempts to isolate Letdown are NOT successful. Additional charging/makeup pumps being required is indicative of a substantial RCS leak.

Site Specific

Loss Threshold #1

RCS subcooling is determined by evaluation of the saturation temperature that corresponds to the indicated reactor coolant system pressure minus the average reactor coolant loop hot leg temperature.

Potential Loss Threshold #1

This threshold is based on the capacity of a single charging pump flow of 129 GPM per UFSAR table 9.1-2.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

RC5 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. U1 UFSAR Table 9.1-2, Chemical and Volume Control System Performance Requirements, Rev 26
3. 1OM-53A.1.6-A, 0F Subcooling Based on Core Exit TCs, Rev 0

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

SG Tube Leakage / Rupture **RC6**

Loss:

1. RUPTURED SG results in an SI actuation.

Potential Loss:

None

Basis:

Generic

This threshold addresses the full spectrum of steam generator (SG) tube rupture events in conjunction with containment barrier loss thresholds. It addresses RUPTURED SG(s) for which the leakage is large enough to cause actuation of ECCS (SI). This is consistent to the RCS leak rate barrier potential loss threshold.

For plants that have implemented Westinghouse Owners Group emergency response guidelines, this condition is described by "entry into E-3 required by EOPs".
By itself, this threshold will result in the declaration of an ALERT. However, if the SG is also FAULTED (i.e., two barriers failed), the declaration escalates to a SITE AREA EMERGENCY per Containment barrier Loss thresholds.

There is no potential loss threshold associated with this item.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

EMERGENCY DIRECTOR Judgment **RC10**

Loss:

1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the RCS barrier.

Potential Loss:

1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the RCS barrier.

Basis:

Generic

These thresholds address any other factors that are to be used by the EMERGENCY DIRECTOR in determining whether the RCS Barrier is lost or potentially lost. In addition, the inability to monitor the barrier should also be incorporated in this EAL as a factor in EMERGENCY DIRECTOR judgment that the barrier may be considered lost or potentially lost.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Critical Safety Function Status **CT1**

Loss:

None

Potential Loss:

1. Containment - Red entry conditions met.

Basis:

Generic

There is no loss threshold associated with this item.

Potential Loss

Red path indicates an extreme challenge to the safety function derived from appropriate instrument readings and/or sampling results, and thus represents a potential loss of containment.

Conditions leading to a containment Red path result from RCS barrier and/or fuel clad barrier loss. Thus, this threshold is primarily a discriminator between SITE AREA EMERGENCY and GENERAL EMERGENCY representing a potential loss of the third barrier.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. FR-Z.1, High Containment Pressure

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

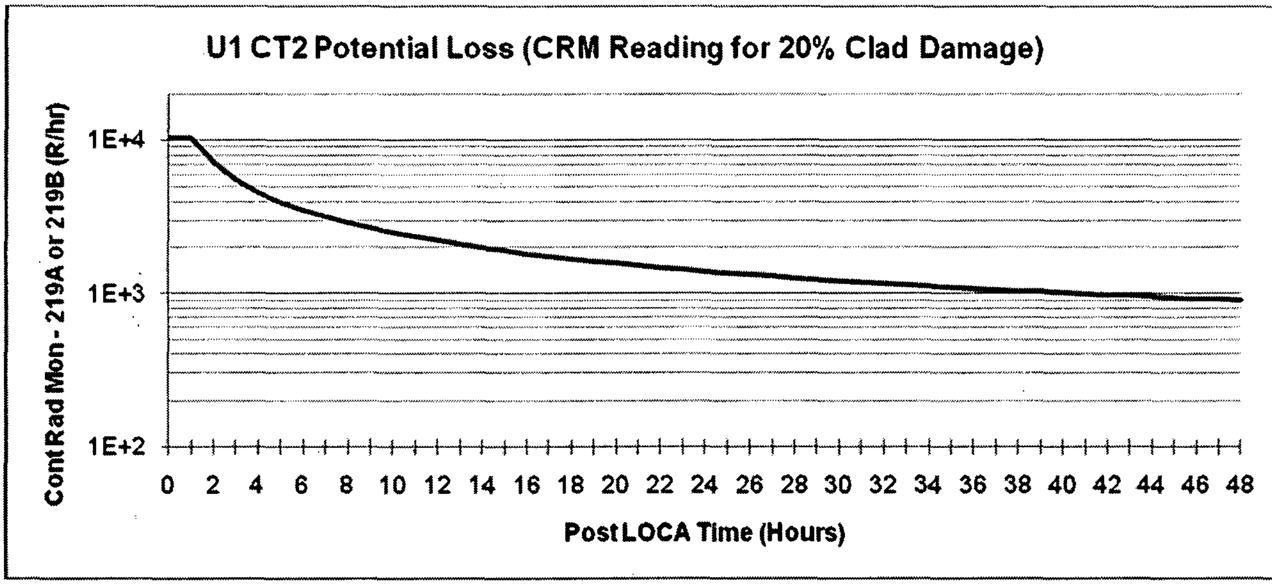
Containment Radiation Monitoring **CT2**

Loss:

None

Potential Loss:

1. Containment Radiation Monitor (RM-1RM-219A or B) > **CT2 Line on Graph F-1.**



Basis:

Generic

There is no loss threshold associated with this item.

The site specific reading is a value which indicates significant fuel damage well in excess of the thresholds associated with both loss of fuel clad and loss of RCS barriers. As stated in Section 3.8 of NEI 99-01 Rev 5, a major release of radioactivity requiring OFFSITE PROTECTIVE ACTIONS from core damage is not possible unless a major failure of fuel cladding allows radioactive material to be released from the core into the reactor coolant.

Regardless of whether containment is challenged, this amount of activity in containment, if released, could have such severe consequences that it is prudent to treat this as a potential loss of containment, such that a GENERAL EMERGENCY declaration is warranted.

NUREG-1228, "Source Term Estimation During Incident Response to Severe Nuclear Power Plant Accidents," indicates that such conditions do not exist when the amount of clad damage is less than 20%.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

CT2 (continued)

Site Specific

The containment radiation monitor readings specified in Graph F-1 were derived using 20% clad damage. The CRM values for the 0 to 1 hour period are set at the 1 hour value for ease of use.

CT2: CRM Readings (R/Hr)

Hrs	RM-1RM-219A or B
0	1.0E+04
1	1.0E+04
2	7.1E+03
3	5.6E+03
4	4.6E+03
5	4.0E+03
6	3.5E+03
7	3.2E+03
8	2.9E+03
12	2.2E+03
16	1.8E+03
20	1.6E+03
24	1.4E+03
28	1.3E+03
32	1.2E+03
36	1.1E+03
40	1.0E+03
44	9.6E+02
48	9.1E+02

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. ERS-SMM-11-002, Containment Radiation Monitor Readings Following Clad Damage (FC2 Loss, FC7 Loss, RC2 Loss and CT2 Potential Loss), Rev 0

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Core Temperature **CT3**

Loss:

None

Potential Loss:

1. a. Five hottest core exit thermocouples > **2000° F**.

   AND

   b. Restoration procedures not effective within **15 minutes**.

   OR

2. a. Five hottest core exit thermocouples > **1200° F**.

   AND

   b. RVLIS Full Range < **40%** with no RCPs running.

   AND

   c. Restoration procedures not effective within **15 minutes**.

Basis:

Generic

There is no loss threshold associated with this item.

The conditions in these thresholds represent an IMMINENT core melt sequence which, if not corrected, could lead to vessel failure and an increased potential for containment failure. In conjunction with the Core Cooling and RCS Leakage criteria in the Fuel and RCS barrier columns, this threshold would result in the declaration of a GENERAL EMERGENCY - loss of two barriers and the potential loss of a third. If the function restoration procedures are ineffective, there is no "success" path.

The function restoration procedures are those EMERGENCY OPERATING PROCEDURES that address the recovery of the core cooling critical safety functions. The procedure is considered effective if the temperature is decreasing or if the vessel water level is increasing.

Severe accident analyses (e.g., NUREG-1150) have concluded that function restoration procedures can arrest core degradation within the reactor vessel in a significant fraction of the core damage scenarios, and that the likelihood of containment failure is very small in these events. Given this, it is appropriate to provide a reasonable period to allow function restoration procedures to arrest the core melt sequence.

Whether or not the procedures will be effective should be apparent within 15 minutes. The EMERGENCY DIRECTOR should make the declaration as soon as it is determined that the procedures have been, or will be ineffective.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

CT3 (continued)

Site Specific

Potential Loss Threshold #1

The BVPS-1 CONTROL ROOM Post Accident Monitoring (PAM) System displays the five (5) hottest core exit thermocouples.

WCAP-14696-A Table 1 provides 2400°F as where a very rapid release of volatile fission products from fuel pellets occurs (departure from failure of fuel rod cladding) and Table 2 establishes core outlet temperatures of > 2000° F as indication of core melt.

The Equipment Qualification Data Package for the Incore Thermocouple provides an extreme qualification of 2200° F, indicating that permanent instrument failure (due to thermocouple materials melting, and potential formation of new junctions) may occur shortly after this EAL threshold value is reached.

Potential Loss Threshold #2

The BVPS-1 CONTROL ROOM Post Accident Monitoring (PAM), Inadequate Core Cooling Monitor (ICCM) displays the five (5) hottest core exit thermocouples.

RVLIS with no RCP's running was added to address 1OM-53A.1.F-0.2, CORE COOLING STATUS TREES.

WCAP-14696-A states, "Analyses performed for the WOG ERGs for indication of inadequate core cooling concluded that the temperature indicated by the core exit thermocouples, especially during transient heatup conditions, is always several hundred degrees lower than the fuel rod cladding temperatures. Thus, an indicated temperature of 1200°F can be translated to a peak cladding temperature on the order of 1400°F."

The RCS level is the lowest accurate RVLIS reading and corresponds to a Core Cooling CSF Red PATH terminus. This combined with a RCS superheating as indicated by CET temperature > 1200° F is the site specific indication indicative of RCS level at the top of active fuel.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. WCAP-14696-A, Westinghouse Owners Group Core Damage Assessment Guidance
3. BVPS-2 Vendor Document 2220.100-001-082, Equipment Qualification Data Package, Incore Thermocouple, Rev A
4. 1OM-53A.1.F-0.2 (ISS1C), Core Cooling Status Trees, Rev 1

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

SG Tube Leakage / Rupture **CT6**

Loss:

Note: A prolonged release is greater than 4 hours.

1. RUPTURED SG is also FAULTED outside of containment.

   OR

2. a. Primary-to-Secondary leak rate **> 10 gpm.**

   AND

   b. UNISOLABLE prolonged steam release from affected SG to the environment.

Potential Loss:

None

Basis:

Generic

The loss threshold recognizes that SG tube leakage can represent a bypass of the Containment Barrier as well as a loss of the RCS Barrier.

Users should realize that the two loss thresholds could be considered redundant. This was recognized during the development process. The inclusion of a threshold that uses emergency procedure commonly used terms like "RUPTURED and FAULTED" adds to the ease of the classification process and has been included based on this human factor concern.

This threshold results in an UNUSUAL EVENT for smaller breaks that: 1) do not exceed the normal charging capacity threshold in RCS leak rate barrier potential loss threshold, or 2) do not result in ECCS actuation in the RCS SG tube rupture barrier loss threshold. For larger breaks, RCS barrier threshold criteria would result in an ALERT. For SG tube ruptures which may involve multiple steam generators or UNISOLABLE secondary line breaks, this threshold would exist in conjunction with RCS barrier thresholds and would result in a SITE AREA EMERGENCY. Escalation to GENERAL EMERGENCY would be based on "Potential Loss" of the Fuel Clad Barrier.

Loss Threshold #1

This threshold addresses the condition in which a RUPTURED steam generator is also FAULTED. This condition represents a bypass of the RCS and containment barriers and is a subset of the second threshold. In conjunction with RCS leak rate barrier loss threshold, this would always result in the declaration of a SITE AREA EMERGENCY.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

CT6 (continued)

Loss Threshold #2

This threshold addresses SG tube leaks that exceed 10 gpm in conjunction with an UNISOLABLE release path to the environment from the affected steam generator. The threshold for establishing the UNISOLABLE secondary side release is intended to be a prolonged release of radioactivity from the RUPTURED steam generator directly to the environment. This could be expected to occur when the main condenser is unavailable to accept the contaminated steam (i.e., SG tube rupture with concurrent loss of OFFSITE power and the RUPTURED steam generator is required for plant cooldown or a stuck open relief valve). If the main condenser is available, there may be releases via air ejectors, gland seal exhausters, and other similar controlled, and often monitored, pathways. These pathways do not meet the intent of an UNISOLABLE release path to the environment. These minor releases are assessed using Abnormal Rad Levels / Radiological Effluent ICs.

Site Specific

The threshold for establishing the UNISOLABLE secondary side release is intended to be a prolonged release of radioactivity from the RUPTURED steam generator directly to the environment. This could be expected to occur when the main condenser is unavailable to accept the contaminated steam (i.e., SG tube RUPTURE with concurrent loss of OFFSITE power and the RUPTURED steam generator is required for plant cooldown or a stuck open relief valve). A prolonged release is greater than 4 hours. The 4 hour duration is the minimum time to cool down to Mode 5, at 100 degrees/hr, per Technical Specification cooldown limits.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Containment Pressure CT8

Loss:

1. A containment pressure rise followed by a rapid UNPLANNED drop in containment pressure.

   OR

2. Containment pressure or sump level response not consistent with LOCA conditions.

Potential Loss:

1. Containment pressure **> 45 psig** and rising.

   OR

2. Containment hydrogen **> 4%**.

   OR

3. a. Containment pressure **> 11 psig.**

   AND

   b. Less than one full train of depressurization equipment operating.

Basis:

Generic

Loss Thresholds #1 and #2

Rapid UNPLANNED loss of pressure (i.e., not attributable to containment spray or condensation effects) following an initial pressure increase from a primary or secondary high energy line break indicates a loss of containment integrity. Containment pressure and sump levels should increase as a result of mass and energy release into containment from a LOCA. Thus, sump level or pressure not increasing indicates containment bypass and a loss of containment integrity.

This indicator relies on operator recognition of an UNPLANNED response for the condition and therefore does not have a specific value associated with it. The UNPLANNED response is important because it is the indicator for a containment bypass condition.

Potential Loss Threshold #1

The site specific pressure is based on the containment design pressure.

Potential Loss Threshold #2

Existence of an explosive mixture means a hydrogen and oxygen concentration of at least the lower deflagration limit curve exists. The indications of potential loss under this EAL corresponds to some of those leading to the Red path in potential loss threshold CT1.1 and may be declared by those sites using CSFSTs.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

CT8 (continued)

Potential Loss Threshold #3

This threshold represents a potential loss of containment in that the containment heat removal/depressurization system (e.g., containment sprays, ice condenser fans, etc., but not including containment venting strategies) are either lost or performing in a degraded manner, as indicated by containment pressure greater than the setpoint at which the equipment was supposed to have actuated.

Site Specific

Potential Loss Threshold #1

This threshold is the containment design pressure of 45 psig and is above the value projected from the design basis loss of coolant accident. The calculated peak containment internal pressure for the design basis loss of coolant accident is contained in the technical specifications.

Potential Loss Threshold #3

Each unit has a containment pressure quench spray system with two 100% capacity trains. These pumps take suction from the RWST and discharge to the spray header. The quench spray system starts on a CIB at the start of a LOCA accident.

The recirculation spray system has four 50% capacity subsystems that consist of a pump and a cooler. The recirculation spray pump takes suction from the containment sump and discharges through a cooler to the spray header. The recirculation spray system does not start during a LOCA until there is low level in the RWST to verify the sump has adequate water inventory. When the RWST level goes very low the quench spray pumps are secured.

A very short period of time could exist where the quench spray system and the recirculation spray system pumps could both be running. Normally it is either the quench spray or the recirculation spray running.

One train of QS System and one train of RS System comprise one full train of depressurization equipment as designed.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. NEI 99-01 Rev 5, FAQ# 10
3. U1 UFSAR 5.2.2, Containment Structure: Design Basis and Loading Criteria, Rev 26
4. U1 UFSAR 6.4, Containment Depressurization System, Rev 26
5. FR-Z.1, High Containment Pressure
6. BVPS-1&2 Technical Specification 5.5.12.b, Containment Leakage Rate Testing Program

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Containment Isolation Failure — CT9

Loss:

Note: Direct pathways include filtered pathways (e.g., SLCRS).

1. a. Failure of **ALL** valves in any one line to close.

   AND

   b. Direct downstream pathway to the environment exists after containment isolation signal.

Potential Loss:

None

Basis:

Generic

This threshold addresses incomplete containment isolation that allows direct release to the environment.

The use of the modifier "direct" in defining the release path discriminates against release paths through interfacing liquid systems. The existence of an in-line charcoal filter does not make a release path indirect since the filter is not effective at removing fission product noble gases. Typical filters have an efficiency of 95-99% removal of iodine. Given the magnitude of the core inventory of iodine, significant releases could still occur. In addition, since the fission product release would be driven by boiling in the reactor vessel, the high humidity in the release stream can be expected to render the filters ineffective in a short period.

There is no potential loss threshold associated with this item.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-4

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

EMERGENCY DIRECTOR Judgment **CT10**

Loss:

1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the containment barrier.

Potential Loss:

1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the containment barrier.

Basis:

Generic

These thresholds address any other factors that are to be used by the EMERGENCY DIRECTOR in determining whether the Containment Barrier is lost or potentially lost. In addition, the inability to monitor the barrier should also be incorporated in this threshold as a factor in EMERGENCY DIRECTOR judgment that the barrier may be considered lost or potentially lost.

The Containment Barrier should not be declared lost or potentially lost based on exceeding Technical Specification action statement criteria, unless there is an event in progress requiring mitigation by the Containment Barrier. When no event is in progress (loss or potentiallLoss of either fuel clad and/or RCS) the Containment Barrier status is addressed by technical specifications.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RG1

INITIATING CONDITION:

OFFSITE dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Notes:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.
- If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results.

1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **15 minutes** or longer:
   - SLCRS Vent (RM-1VS-110 Ch 7) .... **7.66E+02 cpm**
   - Ventilation Vent (RM-1VS-109 Ch 7) .... **6.42E+02 cpm**

   OR

2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER** of the following:
   - **> 1000 mRem** TEDE.
   - **> 5000 mRem** CDE Child Thyroid.

   OR

3. Field survey results at or beyond the site boundary indicate **EITHER** of the following:
   - Gamma (closed window) dose rate **> 1000 mR/hr** for **60 minutes** or longer.
   - Air sample analysis **> 5000 mRem** CDE Child Thyroid for one hour of inhalation.

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RG1 (continued)

Basis:

Generic

This IC addresses radioactivity releases that result in doses at or beyond the site boundary that exceed the EPA PROTECTIVE ACTION GUIDES (PAGs). Public PROTECTIVE ACTIONS will be necessary. Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public and likely involve fuel damage.

The EPA PAGs are expressed in terms of the sum of the effective dose equivalent (EDE) and the committed effective dose equivalent (CEDE), or as the thyroid committed dose equivalent (CDE). For the purpose of these IC/EALs, the dose quantity total effective dose equivalent (TEDE), as defined in 10 CFR 20, is used in lieu of "...sum of EDE and CEDE...."

The TEDE dose is set at the EPA PAG, while the 5000 mRem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

EAL #1

The site specific monitor list in EAL #1 should include effluent monitors on all potential release pathways.

The monitor reading EALs should be determined using a dose assessment method that back calculates from the dose values specified in the IC. Since doses are generally not monitored in real-time, it is suggested that a release duration of one hour be assumed, and that the EALs be based on a site boundary (or beyond) dose of 1000 mRem whole body or 5000 mRem thyroid in one hour, whichever is more limiting (as was done for EALs #2 and #3). If individual site analyses indicate a longer or shorter duration for the period in which the substantial portion of the activity is released, the longer duration should be used.

The meteorology used should be the same as those used for determining RU1 and RA1 monitor reading EALs. The same source term (noble gases, particulates, and halogens) may also be used as long as it maintains a realistic and near linear escalation between the EALs for the four classifications. If proper escalations do not result from the use of the same source term, if the calculated values are unrealistically high, or if correlation between the values and dose assessment values does not exist, then consider using an accident source term for RS1 and RG1 calculations.

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RG1 (continued)

Since dose assessment is based on actual meteorology, whereas the monitor reading EAL is not, the results from these assessments may indicate that the classification is not warranted, or may indicate that a higher classification is warranted. For this reason, EMERGENCY IMPLEMENTING PROCEDURES should call for the timely performance of dose assessments using actual meteorology and release information. If the results of these dose assessments are available when the classification is made (e.g., initiated at a lower classification level), the dose assessment results override the monitor reading EAL.

Site Specific

EAL thresholds reflect state guidance to utilities within their jurisdiction to evaluate the consequences of radiological releases in terms of a CDE Child Thyroid PAG rather than an EPA-400 CDE Thyroid PAG.

EAL #1

The monitor values are based on reaching the limiting PAG at site boundary under the prescribed accident, release, and meteorological conditions. The accident damage nuclide mix is based on a DBA LOCA yield limited to a fuel gap activity release. Complete assumptions and inputs are documented in calculation ERS-MPD-93-007.

Basis Reference(s):

1. NEI 99-01 REV 5, AG1
2. ERS-MPD-93-007, BVPS-U1 Gaseous Radioactivity Monitor Emergency Action Levels, Rev 6

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RS1

INITIATING CONDITION:

OFFSITE dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 100 mRem TEDE or 500 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Notes:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.
- If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results.

1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **15 minutes** or longer:
   - SLCRS Vent (RM-1VS-110 Ch 7)..**7.66E+01 cpm**
   - Ventilation Vent (RM-1VS-109 Ch 7)......................................**6.42E+01 cpm**

   OR

2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER** of the following:
   - **> 100 mRem** TEDE.
   - **> 500 mRem** CDE Child Thyroid.

   OR

3. Field survey results at or beyond the site boundary indicate **EITHER** of the following:
   - Gamma (closed window) dose rate **> 100 mR/hr** for **60 minutes** or longer.
   - Air sample analysis **> 500 mRem** CDE Child Thyroid for one hour of inhalation.

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RS1 (continued)

Basis:

Generic

This IC addresses radioactivity releases that result in doses at or beyond the site boundary that exceed 10% of the EPA PROTECTIVE ACTION GUIDES (PAGs). Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public.

The EPA PAGs are expressed in terms of the sum of the effective dose equivalent (EDE) and the committed effective dose equivalent (CEDE), or as the thyroid committed dose equivalent (CDE). For the purpose of these IC/EALs, the dose quantity total effective dose equivalent (TEDE), as defined in 10 CFR 20, is used in lieu of "...sum of EDE and CEDE...."

The TEDE dose is set at 10% of the EPA PAG, while the 500 mRem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

EAL #1

The site specific monitor list in EAL #1 should include effluent monitors on all potential release pathways.

The monitor reading EALs should be determined using a dose assessment method that back calculates from the dose values specified in the IC. Since doses are generally not monitored in real-time, it is suggested that a release duration of one hour be assumed, and that the EALs be based on a site boundary (or beyond) dose of 100 mRem whole body or 500 mRem thyroid in one hour, whichever is more limiting (as was done for EALs #2 and #3). If individual site analyses indicate a longer or shorter duration for the period in which the substantial portion of the activity is released, the longer duration should be used.

The meteorology used should be the same as those used for determining RU1 and RA1 monitor reading EALs. The same source term (noble gases, particulates, and halogens) may also be used as long as it maintains a realistic and near linear escalation between the EALs for the four classifications. If proper escalations do not result from the use of the same source term, if the calculated values are unrealistically high, or if correlation between the values and dose assessment values does not exist, then consider using an accident source term for RS1 and RG1 calculations.

Since dose assessment is based on actual meteorology, whereas the monitor reading EAL is not, the results from these assessments may indicate that the classification is not warranted, or may indicate that a higher classification is warranted. For this reason, EMERGENCY IMPLEMENTING PROCEDURES should call for the timely performance of dose assessments using actual meteorology and release information. If the results of these dose assessments are available when the classification is made (e.g., initiated at a lower ECL), the dose assessment results override the monitor reading EAL.

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RS1 (continued)

Site Specific

EAL thresholds reflect state guidance to utilities within their jurisdiction to evaluate the consequences of radiological releases in terms of a CDE Child Thyroid PAG rather than an EPA-400 CDE Thyroid PAG.

EAL #1

The monitor values are based on reaching 1/10 the limiting PAG at site boundary under the prescribed accident, release, and meteorological conditions. The accident damage nuclide mix is based on a DBA LOCA yield limited to a fuel gap activity release. Complete assumptions and inputs are documented in calculation ERS-MPD-93-007.

Basis Reference(s):

1. NEI 99-01 Rev 5, AS1
2. NEI 99-01 Rev 5, FAQ# 9
3. ERS-MPD-93-007, BVPS-U1 Gaseous Radioactivity Monitor Emergency Action Levels, Rev 6

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RA1

INITIATING CONDITION:

Any release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM limit for 15 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Note:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **15 minutes** or longer:
   - SLCRS Vent (RM-1VS-110 Ch 5) .... **6.76E+05 cpm**
   - Ventilation Vent (RM-1VS-109 Ch 5) .... **2.94E+05 cpm**

   OR

2. **ANY** of the following liquid effluent monitors **> 200 times the High-High alarm setpoint, not to exceed 8.5E+05 cpm,** established by a current radioactivity discharge permit for **15 minutes** or longer:
   - Liquid Waste Effluent Monitor (RM-1LW-104)
   - Laundry and Contaminated Shower Drains Monitor (RM-1LW-116)

   OR

3. Confirmed sample analysis for gaseous or liquid releases **> 200 times the ODCM limit** for **15 minutes** or longer.

Basis:

Generic

The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

This IC addresses an actual or substantial potential decrease in the level of safety of the plant as indicated by a radiological release that exceeds regulatory commitments for an extended period of time.

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RA1 (continued)

Nuclear power plants incorporate features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, or control and monitor intentional releases. These controls are located in the Offsite Dose Calculation Manual (ODCM). The occurrence of extended, uncontrolled radioactive releases to the environment is indicative of a degradation in these features and/or controls.

The ODCM multiples are specified in RU1 and RA1 only to distinguish between non-emergency conditions, and from each other. While these multiples obviously correspond to an OFFSITE dose or dose rate, the emphasis in classifying these events is the degradation in the level of safety of the plant, not the magnitude of the associated dose or dose rate.

Releases should not be prorated or averaged. For example, a release exceeding 600x ODCM for 5 minutes does not meet the threshold.

This EAL includes any release for which a radioactivity Discharge permit was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit.

<u>EAL #1</u>

This EAL is intended for sites that have established effluent monitoring on non-routine release pathways for which a discharge permit would not normally be prepared.

<u>EAL #2</u>

This EAL addresses radioactivity releases, that for whatever reason, cause effluent radiation monitor readings to exceed the threshold identified in the IC established by the radioactivity discharge permit. This value may be associated with a planned batch release, or a continuous release path.

In either case, the value is established by the ODCM to warn of a release that is not in compliance. Indexing the EAL to the ODCM setpoints in this manner insures that the EAL will never be less than the setpoint established by a specific discharge permit.

<u>EAL #3</u>

This EAL addresses uncontrolled releases that are detected by sample analyses, particularly on unmonitored pathways, e.g., spills of radioactive liquids into storm drains, heat exchanger leakage in river water systems, etc.

<u>Site Specific</u>

An elevated effluent monitor reading where the downstream effluent flow path isolated is not considered a VALID reading.

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RA1 (continued)

EAL #1

The gaseous effluent value of 200 times the ODCM setpoint was determined using formulas, isotopic dose conversion factors and meteorology data as specified in the ODCM based on a normal operating isotopic mixture (no clad damage condition). Assumptions and calculation inputs are provided in ERS-HHM-87-014.

EAL #2

The effluent monitors listed are those normally used for planned discharges. If a discharge is performed using a different flowpath or effluent monitor (e.g., a portable or temporary effluent monitor), then the declaration criteria will be based on the monitor specified in the discharge permit.

The threshold of > 200 times the ODCM limit is calculated by the discharge procedure and is limited to a maximum value of 80% top of scale (top of scale is 1.0E+06 cpm, thus 80% is 8.5E+05 cpm) to assure an on scale readable value.

EAL #3

Grab samples are used to determine release concentrations or release rates, confirm meter readings, or indicate the need for sampling when the effluent monitors are not in service or other alarms occur. The maximum instantaneous release rate limits are calculated in accordance with the ODCM. These are indicated on approved discharge permit release packages.

Basis Reference(s):

1. NEI 99-01 Rev 5, AA1
2. 1/2-ODC-2.01, ODCM: Liquid Effluents
3. 1/2-ODC-2.02, ODCM: Gaseous Effluents
4. ERS-HHM-87-014, Unit 1 / Unit 2 ODCM Gaseous Effluent Monitor Setpoints, Rev 4
5. ERS-ATL-93-021, Process Alarm Setpoints for Liquid Effluent Monitors, Rev 3

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RU1

INITIATING CONDITION:

Any release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Note:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **60 minutes** or longer:
   - SLCRS Vent (RM-1VS-110 Ch 5) .... **6.76E+03 cpm**
   - Ventilation Vent (RM-1VS-109 Ch 5) .... **2.94E+03 cpm**

   OR

2. **ANY** of the following liquid effluent monitors **> 2 times the High-High alarm setpoint** established by a current radioactivity discharge permit for **60 minutes** or longer:
   - Liquid Waste Effluent Monitor (RM-1LW-104)
   - Laundry and Contaminated Shower Drains Monitor (RM-1LW-116)

   OR

3. Confirmed sample analysis for gaseous or liquid releases **> 2 times the ODCM limit** for **60 minutes** or longer.

Basis:

Generic

The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

This IC addresses a potential decrease in the level of safety of the plant as indicated by a radiological release that exceeds regulatory commitments for an extended period of time.

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RU1 (continued)

Nuclear power plants incorporate features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, or control and monitor intentional releases. These controls are located in the Offsite Dose Calculation Manual (ODCM). The occurrence of extended, uncontrolled radioactive releases to the environment is indicative of a degradation in these features and/or controls.

The ODCM multiples are specified in RU1 and RA1 only to distinguish between non-emergency conditions, and from each other. While these multiples obviously correspond to an OFFSITE dose or dose rate, the emphasis in classifying these events is the degradation in the level of safety of the plant, not the magnitude of the associated dose or dose rate.

Releases should not be prorated or averaged. For example, a release exceeding 4x ODCM for 30 minutes does not meet the threshold.

This EAL includes any release for which a radioactivity Discharge permit was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit.

<u>EAL #1</u>

This EAL addresses radioactivity releases, that for whatever reason, cause effluent radiation monitor readings to exceed the threshold identified in the IC.

This EAL is intended for sites that have established effluent monitoring on non-routine release pathways for which a Discharge permit would not normally be prepared.

The ODCM establishes a methodology for determining effluent radiation monitor setpoints. The ODCM specifies default source terms and, for gaseous releases, prescribes the use of pre-determined annual average meteorology in the most limiting downwind sector for showing compliance with the regulatory commitments. This EAL is determined using this methodology.

<u>EAL #2</u>

This EAL addresses radioactivity releases, that for whatever reason, cause effluent radiation monitor readings to exceed the threshold identified in the IC established by the radioactivity discharge permit. This value may be associated with a planned batch release, or a continuous release path.

In either case, the value is established by the ODCM to warn of a release that is not in compliance. Indexing the EAL to the ODCM setpoints in this manner insures that the EAL will never be less than the setpoint established by a specific discharge permit.

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RU1 (continued)

EAL #3

This EAL addresses uncontrolled releases that are detected by sample analyses, particularly on unmonitored pathways, e.g., spills of radioactive liquids into storm drains, heat exchanger leakage in river water systems, etc.

Site Specific

An elevated monitor reading while the effluent flow path is isolated is not considered a VALID reading.

EAL #1

The gaseous effluent values of 2 times the ODCM setpoint were determined using formulas, isotopic dose conversion factors and meteorology data as specified in the ODCM based on a normal operating isotopic mixture (no clad damage condition). Assumptions and calculation inputs are provided in ERS-HHM-87-014.

EAL #2

The effluent monitors listed are those normally used for planned discharges. If a discharge is performed using a different flowpath or effluent monitor (e.g., a portable or temporary effluent monitor), then the declaration criteria will be based on the monitor specified in the discharge permit.

EAL #3

Grab samples are used to: determine release concentrations or release rates, confirm meter readings, or indicate the need for sampling when the effluent monitors are not in service or other alarms occur. The maximum instantaneous release rate limits are calculated in accordance with the ODCM. These are indicated on approved discharge permit release packages.

Basis Reference(s):

1. NEI 99-01 Rev 5, AU1
2. 1/2-ODC-2.01, ODCM: Liquid Effluents
3. 1/2-ODC-2.02, ODCM: Gaseous Effluents
4. ERS-HHM-87-014, Unit 1 / Unit 2 ODCM Gaseous Effluent Monitor Setpoints, Rev 4
5. ERS-ATL-93-021, Process Alarm Setpoints for Liquid Effluent Monitors, Rev 3

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RA2

INITIATING CONDITION:

Damage to irradiated fuel or loss of water level that has resulted or will result in the uncovering of irradiated fuel outside the reactor vessel.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. A water level drop in the spent fuel pool, transfer canal or reactor cavity that will result in irradiated fuel becoming uncovered.

   OR

2. **> 1000 mR/hr** on **ANY** of the following due to damage to irradiated fuel or loss of water level:
   - Manipulator Crane Area Monitor (RM-1RM-203)
   - Fuel Pool Bridge Area Monitor (RM-1RM-207)

Basis:

__Generic__

This IC addresses increases in radiation dose rates within plant buildings, and may be a precursor to a radioactivity release to the environment. These events represent a loss of control over radioactive material and represent an actual or substantial potential degradation in the level of safety of the plant.

These events escalate from RU2 in that fuel activity has been released, or is anticipated due to fuel heatup. This IC applies to spent fuel requiring water coverage and is not intended to address spent fuel which is licensed for dry storage.

__EAL #1__

Site specific indications may include instrumentation such as water level and local area radiation monitors, and personnel (e.g., refueling crew) reports. If available, video cameras may allow remote observation. Depending on available level instrumentation, the declaration threshold may need to be based on indications of water makeup rate or decrease in water storage tank level.

__EAL #2__

This EAL addresses radiation monitor indications of fuel uncovery and/or fuel damage.

Increased ventilation monitor readings may be indication of a radioactivity release from the fuel, confirming that damage has occurred. Increased background at the ventilation monitor due to water level decrease may mask increased ventilation exhaust airborne activity and needs to be considered.

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RA2 (continued)

While a radiation monitor could detect an increase in dose rate due to a drop in the water level, it might not be a reliable indication of whether or not the fuel is covered.

For example, a refueling bridge radiation monitor reading may increase due to planned evolutions such as head lift, or even a fuel assembly being raised in the manipulator mast. Also, a monitor could in fact be properly responding to a known event involving transfer or relocation of a source, stored in or near the fuel pool or responding to a planned evolution such as removal of the reactor head. Generally, increased radiation monitor indications will need to be combined with another indicator (or personnel report) of water loss.

Site Specific

EAL #1

The cavity water level is verified >23 feet by verifying alarm A6-30 "Refueling Cavity Water Level Low" is off. When in drain down to remove the head, the cavity level is also monitored by LI-1RC-481C RCS Refueling Level, LI-1FW-475 Temporary RCS Refueling Level Loop A ,or Local standpipe (tygon hose).

EAL #2

NUREG/CR-4982, "Severe Accident in Spent Fuel Pools in Support of Generic Safety Issue 82," (July, 1987) indicates that even if CORRECTIVE ACTIONS are not taken when spent fuel becomes uncovered, no prompt fatalities are predicted and the risk of injury is low. Therefore, a period of time will be available to take CORRECTIVE ACTIONS prior to the actual onset of fuel damage.

Visual observation of spent fuel uncovery represents a major ALARA concern in that radiation levels could exceed 10,000 R/hr on the refuel bridge when uncovery occurs. The value of 1000 mR/hr was conservatively chosen for classification purposes.

Basis Reference(s):

1. NEI 99-01 Rev 5, AA2
2. Information Notice No. 90-08, KR-85 Hazards from Decayed Fuel

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RU2

INITIATING CONDITION:

UNPLANNED rise in plant radiation levels.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. a. UNPLANNED water level drop in the spent fuel pool, transfer canal or reactor cavity as indicated by level **< Tech Spec Minimum (23 feet)**.

   AND

   b. Area radiation monitor reading rise resulting in a High-High alarm on **ANY** of the following:

   - Manipulator Crane (RM-1RM-203)
   - Fuel Pool Bridge Crane (RM-1RM-207)

   OR

2. UNPLANNED area radiation monitor or radiation survey **> 1000 times NORMAL LEVELS**.

Basis:

<u>Generic</u>

This IC addresses increased radiation levels as a result of water level decreases above irradiated fuel or events that have resulted, or may result, in UNPLANNED increases in radiation dose rates within plant buildings. These radiation increases represent a loss of control over radioactive material and represent a potential degradation in the level of safety of the plant.

<u>EAL #1</u>

Site specific indications may include instrumentation such as water level and local area radiation monitors, and personnel (e.g., refueling crew) reports. If available, video cameras may allow remote observation. Depending on available level instrumentation, the declaration threshold may need to be based on indications of water makeup rate or decrease in water storage tank level.

The refueling pathway is a site specific combination of cavities, tubes, canal and pools. While a radiation monitor could detect an increase in dose rate due to a drop in the water level, it might not be a reliable indication of whether or not the fuel is covered.

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RU2 (continued)

For example, a refueling bridge radiation monitor reading may increase due to planned evolutions such as head lift, or even a fuel assembly being raised in the manipulator mast. Also, a monitor could in fact be properly responding to a known event involving transfer or relocation of a source, stored in or near the fuel pool or responding to a planned evolution such as removal of the reactor head. Generally, increased radiation monitor indications will need to be combined with another indicator (or personnel report) of water loss.

For refueling events where the water level drops below the RPV flange classification would be via CU8. This event escalates to an ALERT per RA2 if irradiated fuel outside the reactor vessel is uncovered. For events involving irradiated fuel in the reactor vessel, escalation would be via the Fission Product Barrier Table for events in operating modes 1-4.

EAL #2

This EAL addresses increases in plant radiation levels that represent a loss of control of radioactive material resulting in a potential degradation in the level of safety of the plant.

This EAL excludes radiation level increases that result from planned activities such as use of radiographic sources and movement of radioactive waste materials. A specific list of ARMs is not required as it would restrict the applicability of the EAL. The intent is to identify loss of control of radioactive material in any monitored area.

Site Specific

EAL Threshold 1.b

Routine rises in radiation monitor readings occur at Beaver Valley due to changes in water level, fuel movement and other routine activities. Radiation monitor setpoints are usually established several millirem above background. The EAL threshold was specified that the rise in the radiation monitor reading would result in an alarm to preclude unwarranted declaration due to expected changes in background levels while still providing indication of loss of water level event.

Basis Reference(s):

1. NEI 99-01 Rev 5, AU2
2. NEI 99-01 Rev 5, FAQ# 5
3. Information Notice No. 90-08, KR-85 Hazards from Decayed Fuel
4. BVPS-1&2 Technical Specification 3.7.15, Fuel Storage Pool Water Level
5. BVPS-1&2 Technical Specification 3.9.6, Refueling Cavity Water Level

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RA3

INITIATING CONDITION:

Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. Dose rate **> 15 mR/hr** in **ANY** of the following areas requiring continuous occupancy to maintain plant safety functions:
   - CONTROL ROOM
   - Central Alarm Station
   - Secondary Alarm Station

Basis:

Generic

This IC addresses increased radiation levels that impede continued operation in areas requiring continuous occupancy to maintain safe operation or to perform a safe shutdown.

The cause and/or magnitude of the increase in radiation levels is not a concern of this IC. The EMERGENCY DIRECTOR must consider the source or cause of the increased radiation levels and determine if any other IC may be involved.

The value of 15 mR/hr is derived from the GDC 19 value of 5 Rem in 30 days with adjustment for expected occupancy times. Although Section III.D.3 of NUREG-0737, "Clarification of TMI Action Plan Requirements," provides that the 15 mR/hr value can be averaged over the 30 days, the value is used here without averaging, as a 30 day duration implies an event potentially more significant than an ALERT.

Areas requiring continuous occupancy include the CONTROL ROOM and, as appropriate to the site, any other control stations that are staffed continuously, such as a radwaste CONTROL ROOM or a security alarm station.

Site Specific

Areas requiring continuous occupancy include the CONTROL ROOM, Central Alarm Station (CAS) and the Secondary Alarm Station (SAS). Although the CAS and SAS are not required for the control of plant safety functions, they are included in this EAL because of Security Plan requirements for continuous occupancy.

RECOGNITION CATEGORY
RADIOLOGICAL EFFLUENTS / ABNORMAL RADIATION LEVELS

RA3 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, AA3
2. Physical Security Plan/Contingency Plan

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HG1

INITIATING CONDITION:

HOSTILE ACTION resulting in loss of physical control of the facility.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. A HOSTILE ACTION has occurred such that plant personnel are unable to operate equipment required to maintain safety functions listed below:
   - Reactivity Control (ability to shut down the reactor and keep it shut down)
   - RCS inventory (ability to cool the core)
   - Secondary heat removal (ability to maintain a heat sink)

   OR

2. A HOSTILE ACTION has caused failure of spent fuel cooling systems and IMMINENT fuel damage is likely.

Basis:

Generic

EAL #1

This EAL encompasses conditions under which a HOSTILE ACTION has resulted in a loss of physical control of VITAL AREAS (containing VITAL EQUIPMENT or controls of VITAL EQUIPMENT) required to maintain safety functions and control of that equipment cannot be transferred to and operated from another location.

Typically, these safety functions are reactivity control (ability to shut down the reactor and keep it shutdown), RCS inventory (ability to cool the core), and secondary heat removal (ability to maintain a heat sink).

Loss of physical control of the CONTROL ROOM or remote shutdown capability alone may not prevent the ability to maintain safety functions. Design of the remote shutdown capability and the location of the transfer switches should be taken into account. Primary emphasis should be placed on those components and instruments that supply protection for and information about safety functions.

If control of the plant equipment necessary to maintain safety functions can be transferred to another location, then the threshold is not met.

EAL #2

This EAL addresses failure of spent fuel cooling systems as a result of HOSTILE ACTION if IMMINENT fuel damage is likely.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HG1 (continued)

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HG1
2. NEI 99-01 Rev 5, FAQ# 29
3. Physical Security Plan/Contingency Plan

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HS1

INITIATING CONDITION:

HOSTILE ACTION within the PROTECTED AREA.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the Security Shift Supervisor.

Basis:

Generic

This condition represents an escalated threat to plant safety above that contained in the ALERT in that a HOSTILE FORCE has progressed from the OWNER CONTROLLED AREA to the PROTECTED AREA.

This EAL addresses the contingency for a very rapid progression of events, such as that experienced on September 11, 2001. It is not premised solely on the potential for a radiological release. Rather the issue includes the need for rapid assistance due to the possibility for significant and indeterminate damage from additional air, land or water attack elements.

The fact that the site is under serious attack with minimal time available for further preparation or additional assistance to arrive requires Offsite Response Organization (ORO) readiness and preparation for the implementation of protective measures.

This EAL addresses the potential for a very rapid progression of events due to a HOSTILE ACTION. It is not intended to address incidents that are accidental events or acts of civil disobedience, such as small aircraft impact, hunters, or physical disputes between employees within the PROTECTED AREA. Those events are adequately addressed by other EALs.

Although nuclear plant security officers are well trained and prepared to protect against HOSTILE ACTION, it is appropriate for OROs to be notified and encouraged to begin preparations for public PROTECTIVE ACTIONS (if they do not normally) to be better prepared should it be necessary to consider further actions.

If not previously notified by NRC that the airborne HOSTILE ACTION was intentional, then it would be expected, although not certain, that notification by an appropriate Federal agency would follow. In this case, appropriate Federal agency is intended to be NORAD, FBI, FAA or NRC. However, the declaration should not be unduly delayed awaiting Federal notification.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HS1 (continued)

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HS4
2. Physical Security Plan/Contingency Plan

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA1

INITIATING CONDITION:

HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the Security Shift Supervisor.

   OR

2. A validated notification from the NRC of a LARGE AIRCRAFT attack threat within **30 minutes** of the site.

Basis:

Generic

Note: Timely and accurate communication between Security Shift Supervision and the CONTROL ROOM is crucial for the implementation of effective Security EALs.

These EALs address the contingency for a very rapid progression of events, such as that experienced on September 11, 2001. They are not premised solely on the potential for a radiological release. Rather the issue includes the need for rapid assistance due to the possibility for significant and indeterminate damage from additional air, land or water attack elements.

The fact that the site is under serious attack or is an identified attack target with minimal time available for further preparation or additional assistance to arrive requires a heightened state of readiness and implementation of protective measures that can be effective (such as ONSITE evacuation, dispersal or sheltering).

EAL #1

This EAL addresses the potential for a very rapid progression of events due to a HOSTILE ACTION. It is not intended to address incidents that are accidental events or acts of civil disobedience, such as small aircraft impact, hunters, or physical disputes between employees within the OWNER CONTROLLED AREA. Those events are adequately addressed by other EALs.

Note that this EAL is applicable for any HOSTILE ACTION occurring, or that has occurred, in the OWNER CONTROLLED AREA. This includes ISFSI's that may be outside the PROTECTED AREA but still within the OWNER CONTROLLED AREA.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA1 (continued)

Although nuclear plant security officers are well trained and prepared to protect against HOSTILE ACTION, it is appropriate for the Offsite Response Organization (ORO) to be notified and encouraged to begin activation (if they do not normally) to be better prepared should it be necessary to consider further actions.

If not previously notified by the NRC that the airborne HOSTILE ACTION was intentional, then it would be expected, although not certain, that notification by an appropriate Federal agency would follow. In this case, appropriate Federal agency is intended to be NORAD, FBI, FAA or NRC. However, the declaration should not be unduly delayed awaiting Federal notification.

EAL #2

This EAL addresses the immediacy of an expected threat arrival or impact on the site within a relatively short time.

The intent of this EAL is to ensure that notifications for the LARGE AIRCRAFT attack threat are made in a timely manner and that OROs and plant personnel are at a state of heightened awareness regarding the credible threat.

This EAL is met when a plant receives information regarding an airliner attack threat from NRC and the airliner is within 30 minutes of the plant. Only the plant to which the specific threat is made need declare the ALERT.

The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves a LARGE AIRCRAFT. The status and size of the plane may be provided by NORAD through the NRC.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HA4
2. NEI 99-01 Rev 5, FAQ# 26
3. Physical Security Plan/Contingency Plan

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU1

INITIATING CONDITION:

Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. A SECURITY CONDITION that does not involve a HOSTILE ACTION as reported by the Security Shift Supervisor.

   OR

2. A credible site specific security threat notification.

   OR

3. A validated notification from the NRC providing information of a LARGE AIRCRAFT threat.

Basis:

Generic

Note: Timely and accurate communication between Security Shift Supervision and the CONTROL ROOM is crucial for the implementation of effective Security EALs.

Security events which do not represent a potential degradation in the level of safety of the plant are reported under 10 CFR 73.71 or in some cases under 10 CFR 50.72. Security events assessed as HOSTILE ACTIONs are classifiable under HA1, HS1 and HG1.

A higher initial classification could be made based upon the nature and timing of the Security Threat and potential consequences. The licensee shall consider upgrading the emergency response status and EMERGENCY CLASSIFICATION LEVEL in accordance with the site's Safeguards Contingency Plan and Emergency Plan.

EAL #1

Reference is made to site specific security shift supervision because these individuals are the designated personnel ONSITE qualified and trained to confirm that a security event is occurring or has occurred. Training on security event classification confirmation is closely controlled due to the strict secrecy controls placed on the plant Safeguards Contingency Plan.

This threshold is based on site specific security plans. Site specific Safeguards Contingency Plans are based on guidance provided by NEI 03-12.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU1 (continued)

EAL #2

This threshold is included to ensure that appropriate notifications for the security threat are made in a timely manner. This includes information of a credible threat. Only the plant to which the specific threat is made need declare the UNUSUAL EVENT.

The determination of "credible" is made through use of information found in the site specific Safeguards Contingency Plan.

EAL #3

The intent of this EAL is to ensure that notifications for the aircraft threat are made in a timely manner and that Offsite Response Organizations (OROs) and plant personnel are at a state of heightened awareness regarding the credible threat. It is not the intent of this EAL to replace existing non-hostile related EALs involving aircraft.

This EAL is met when a plant receives information regarding an aircraft threat from NRC. Validation is performed by calling the NRC or by other approved methods of authentication. Only the plant to which the specific threat is made need declare the UNUSUAL EVENT.

The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves a LARGE AIRCRAFT. The status and size of the plane may be provided by NORAD through the NRC.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HU4
2. NEI 99-01 Rev 5, FAQ# 26
3. Physical Security Plan/Contingency Plan

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HS2

INITIATING CONDITION:

CONTROL ROOM evacuation has been initiated and plant control cannot be established.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. a. CONTROL ROOM evacuation has been initiated.

   AND

   b. Control of **ANY** of the following safety functions is not established from an alternate location within **15 minutes**.

   - Reactivity Control (ability to shut down the reactor and keep it shut down)
   - RCS inventory (ability to cool the core)
   - Secondary heat removal (ability to maintain a heat sink)

Basis:

Generic

The intent of this IC is to capture those events where control of the plant cannot be reestablished in a timely manner. In this case, expeditious transfer of control of safety systems has not occurred (although fission product barrier damage may not yet be indicated).

The intent of the EAL is to establish control of important plant equipment and knowledge of important plant parameters in a timely manner. Primary emphasis should be placed on those components and instruments that supply protection for and information about safety functions. Typically, these safety functions are reactivity control (ability to shutdown the reactor and maintain it shutdown), RCS inventory (ability to cool the core), and secondary heat removal (ability to maintain a heat sink).

The determination of whether or not control is established at the remote shutdown panel is based on EMERGENCY DIRECTOR judgment. The EMERGENCY DIRECTOR is expected to make a reasonable, informed judgment within the site specific time for transfer that the licensee has control of the plant from the remote shutdown panel.

The site specific time for transfer is based on analysis or assessments as to how quickly control must be reestablished without core uncovering and/or core damage. This time should not exceed 15 minutes without additional justification.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HS2 (continued)

Site Specific

The 15 minute time for transfer is based on analysis or assessments as to how quickly control must be reestablished without core uncovering and/or core damage. The 15 minute time period starts when either the control of the plant is no longer maintained in the CONTROL ROOM or the last operator has left the CONTROL ROOM.

Basis Reference(s):

1. NEI 99-01 Rev 5, HS2
2. 1OM-53C.4.1.33.1A, Control Room Inaccessibility, Rev 12
3. 1OM-56C.4.B, Alternate Safe Shutdown from Outside Control Room, Rev 42

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA2

INITIATING CONDITION:

CONTROL ROOM evacuation has been initiated.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. CONTROL ROOM evacuation has been initiated.

Basis:

Generic

With the CONTROL ROOM evacuated, additional support, monitoring and direction through the TECHNICAL SUPPORT CENTER and/or other emergency response facilities may be necessary.

Site Specific

AOP 1.33.1A specifies conditions under which CONTROL ROOM evacuation may be necessary. This EAL is only applicable when the decision has been made to evacuate the CONTROL ROOM, not when conditions are being evaluated per 1OM-53C.4.1.33.1A.

Basis Reference(s):

1. NEI 99-01 Rev 5, HA5
2. NEI 99-01 Rev 5, FAQ# 28
3. 1OM-53C.4.1.33.1A, Control Room Inaccessibility, Rev 12
4. 1OM-56C.4.B, Alternate Safe Shutdown from Outside Control Room, Rev 42

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA3

INITIATING CONDITION:

Natural or destructive phenomena affecting VITAL AREAS.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. a. Seismic event **> 0.06g (OBE)** acceleration (as indicated by analysis of the **Accelerograph Recording System** or lit lamp on 2ERS-CCC-1 Seismic Instrumentation Central Control Cabinet).

   AND

   b. Earthquake confirmed by **ANY** of the following:

   - Earthquake felt in plant.
   - National Earthquake Center.
   - CONTROL ROOM indication of degraded performance of systems required for the safe shutdown of the plant.

OR

2. Tornado or high winds **> 80 mph** resulting in **EITHER** of the following:

   - VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

OR

3. Internal flooding in **Table H-1** areas resulting in **EITHER** of the following:

   - Electrical shock hazard that precludes access to operate or monitor safety equipment.
   - CONTROL ROOM indication of degraded performance of those safety systems.

OR

4. High river water level **> 705 feet MSL** resulting in **EITHER** of the following:

   - VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA3 (continued)

OR

5. Low river level (LR-1CW-101) **< 650 feet MSL** resulting in CONTROL ROOM indication of degraded performance of safety systems located in **Table H-1** areas.

OR

6. Turbine failure-generated PROJECTILES resulting in **EITHER** of the following:
   - VISIBLE DAMAGE to or penetration of **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

OR

7. Vehicle crash resulting in **EITHER** of the following:
   - VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

Table H-1
• Cable Tunnel (CV-3)
• CONTROL ROOM
• Containment Building
• Demin. Water Storage Tank (1WT-TK-10)
• Diesel Generator Building
• Fuel Building
• Intake Structure Pump Cubicles
• Safeguards (including AFW, Main Steam and Cable Vault Areas)
• Primary Auxiliary Building (except elev. 768')
• RWST (1QS-TK-1)
• Service Building (below elev. 735')

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA3 (continued)

<u>Generic</u>

These EALs escalate from HU3 in that the occurrence of the event has resulted in VISIBLE DAMAGE to plant structures or areas containing equipment necessary for a safe shutdown, or has caused damage to the safety systems in those structures evidenced by CONTROL ROOM indications of degraded system response or performance. The occurrence of VISIBLE DAMAGE and/or degraded system response is intended to discriminate against lesser events. The initial report should not be interpreted as mandating a lengthy damage assessment prior to classification. No attempt is made in this EAL to assess the actual magnitude of the damage. The significance here is not that a particular system or structure was damaged, but rather, that the event was of sufficient magnitude to cause this degradation.

<u>EALs #2 - #6</u>

These EALs should specify site specific structures or areas that contain safety system, or component and functions required for safe shutdown of the plant. Site specific Safe Shutdown Analysis should be consulted for equipment and plant areas required to establish or maintain safe shutdown.

<u>EAL #1</u>

Seismic events of this magnitude can result in a VITAL AREA being subjected to forces beyond design limits, and thus damage may be assumed to have occurred to plant safety systems.

This threshold should be based on site specific FSAR design basis. See EPRI-sponsored "Guidelines for Nuclear Plant Response to an Earthquake", dated October 1989, for information on seismic event categories.

The National Earthquake Center can confirm if an earthquake has occurred in the area of the plant.

<u>EAL #2</u>

This EAL is based on a tornado striking (touching down) or high winds that have caused VISIBLE DAMAGE to structures containing functions or systems required for safe shutdown of the plant.

The high wind value should be based on site specific FSAR design basis as long as it is within the range of the instrumentation available for wind speed.

<u>EAL #3</u>

This EAL addresses the effect of internal flooding caused by events such as component failures, equipment misalignment, or outage activity mishaps. It is based on the degraded performance of systems, or has created industrial safety hazards (e.g., electrical shock) that preclude necessary access to operate or monitor safety equipment. The inability to access, operate or monitor safety equipment represents an actual or substantial potential degradation of the level of safety of the plant.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA3 (continued)

Flooding as used in this EAL describes a condition where water is entering the room faster than installed equipment is capable of removal, resulting in a rise of water level within the room. Classification of this EAL should not be delayed while CORRECTIVE ACTIONS are being taken to isolate the water source.

The site specific areas include those areas that contain systems required for safe shutdown of the plant, which are not designed to be partially or fully submerged. The plant's IPEEE may provide insight into areas to be considered when developing this EAL.

EAL #4 and #5

This EAL addresses other site specific phenomena that result in VISIBLE DAMAGE to VITAL AREAS or results in indication of damage to safety structures, systems, or components containing functions and systems required for safe shutdown of the plant (such as hurricane, flood, or seiche) that can also be precursors of more serious events.

EAL #6

This EAL addresses the threat to safety related equipment imposed by PROJECTILES generated by main turbine rotating component failures. Therefore, this EAL is consistent with the definition of an ALERT in that the potential exists for actual or substantial potential degradation of the level of safety of the plant.

The site specific list of areas should include all areas containing safety structure, system, or component, their controls, and their power supplies.

EAL #7

This EAL addresses vehicle crashes within the PROTECTED AREA that results in VISIBLE DAMAGE to VITAL AREAS or indication of damage to safety structures, systems, or components containing functions and systems required for safe shutdown of the plant.

Site Specific

Table H-1 lists areas that house equipment that is needed to ensure safe shutdown of the plant. Personnel access to those areas may be an important factor in monitoring and controlling equipment operability. Table H-1 includes structures that are in contact with or immediately adjacent to (directly impacts or obstructs) the areas that actually contain the equipment of concern.

EAL #1

The Maximum Probable Earthquake is 0.06g. It is the conservatively determined earthquake and associated ground motion that might reasonably or probably be expected to occur at the nuclear plant site. The Maximum Probable Earthquake is similar to the Operating Basis Earthquake (OBE) terminology used by the NRC.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA3 (continued)

As defined in the EPRI-sponsored "Guidelines for Nuclear Plant Response to an Earthquake", dated October 1989, a "felt earthquake" is "An earthquake of sufficient intensity such that: (a) the inventory ground motion is felt at the nuclear plant site and recognized as an earthquake based on a consensus of CONTROL ROOM operators on duty at the time, and (b) for plants with operable seismic instrumentation, the seismic switches of the plant are activated."

EAL #2

The wind speed threshold is based on station structural wind load design criteria for a wind velocity of 80 mph at a nominal 30 feet above the ground (the "fastest mile" American Society of Civil Engineers estimation for a 100 year recurrence interval). This is considered ground level windspeed and is consistent with the 35 foot Meteorological sensor location.

Wind speed is obtained from meteorological data in the CONTROL ROOM that is averaged over a 15 minute period to prevent instantaneous wind gusts or fluctuations from affecting the measurement.

EAL #4

A river level greater than 705' mean sea level is consistent with the elevation of the main transformer pad. This river level will permit flooding to occur within the turbine building, although no safety related equipment is expected to be affected at this elevation.

Indicators to support this determination may include:

1) LR-1CW-101, Ohio River Water Level Recorder,
2) Intake Structure river level indication (ruler markings on outside of Intake Building), or
3) Montgomery Lock or National Weather Service reports Montgomery Lower Pool Level Gauge Reading > 52.48 Ft (equivalent to 705' MSL).

Note: Mean Sea Level = Lower Gauge Reading + 652.52 Ft.

Phone numbers to contact Montgomery Lock and the National Weather Service are located on Form 1/2-EPP-IP-1.1.F02.

EAL #5

At a river level of about 650' normal river water or service water pump (full-flow) into the intake bay will be greater than gravity-fed in-flow from the river itself, causing the intake bay water level to drop eventually resulting in intake pump low flow and reduced service life. When river level drops below 650', valves may be manually throttled to reduce pump flows in order to prevent a lowering level in the intake bay. The throttled cooling water at this river level will provide for decay heat removal and other normal operating pumps (i.e., charging), but cannot provide for containment coolers and other emergency

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA3 (continued)

event equipment. River water level below 650' constitutes a reduced margin of safety state due to cooling flow rates below normal.

EAL #7

This threshold addresses events such as plane, helicopter, train, barge, car or truck crashes, or impact of PROJECTILES into a plant Safe Shutdown VITAL AREA.

Basis Reference(s):

1. NEI 99-01 Rev 5, HA1
2. U1 UFSAR Table A.1-1, Category I Structures, Systems, and Components, Rev 26
3. U1 UFSAR, Section 1.3.3.27, Ultimate Heat Sink (Safety Guide 27), Rev 26
4. U1 UFSAR Section 2.3.1.2, River Stage, Rev 26
5. U1 UFSAR Figure 2.5-5, Response Spectra 0.06g OBE (Based on Soil-Structure), Rev 26
6. U1 UFSAR Section 2.7.1.1, Seismic Category I Structures, Rev. 26
7. 1/2OM-53C.4A.75.4, Acts of Nature, Dam Failure, Rev 7
8. N-779, BVPS Unit 1 and Unit 2 Response to a Dam Failure, Rev 1
9. Form 1/2-EPP-IP-1.1.F02
10. 2OM-45B.4.AAA, Init of Seismic Exceed Preset And/Or Spectral Accelerations

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU3

INITIATING CONDITION:

Natural or destructive phenomena affecting the PROTECTED AREA.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. a. Seismic event **> 0.01g** acceleration (as indicated by initiation of the **Accelerograph Recording System** on A11-59, Seismic Accelerograph Operation).

   AND

   b. Earthquake confirmed by **EITHER** of the following:

   - Earthquake felt in plant
   - National Earthquake Center

   OR

2. a. Tornado within the PROTECTED AREA.

   OR

   b. High winds **> 80 mph**.

   OR

3. Internal flooding in **Table H-1** areas that has the potential to affect safety related equipment required by Technical Specifications for the current operating mode.

   OR

4. High river water level **> 705 feet MSL**.

   OR

5. Low river water level (LR-1CW-101) **< 650 feet MSL**.

   OR

6. Turbine failure resulting in casing penetration or damage to turbine or generator seals.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU3 (continued)

Table H-1
• Cable Tunnel (CV-3) • CONTROL ROOM • Containment Building • Demin. Water Storage Tank (1WT-TK-10) • Diesel Generator Building • Fuel Building • Intake Structure Pump Cubicles • Safeguards (including AFW, Main Steam and Cable Vault Areas) • Primary Auxiliary Building (except elev. 768') • RWST (1QS-TK-1) • Service Building (below elev. 735')

Basis:

Generic

These EALs are categorized on the basis of the occurrence of an event of sufficient magnitude to be of concern to plant operators.

EAL #1

Damage may be caused to some portions of the site, but should not affect ability of safety functions to operate.

As defined in the EPRI-sponsored "Guidelines for Nuclear Plant Response to an Earthquake," dated October 1989, a "felt earthquake" is "An earthquake of sufficient intensity such that: (a) the vibratory ground motion is felt at the nuclear plant site and recognized as an earthquake based on a consensus of CONTROL ROOM operators on duty at the time, and (b) for plants with operable seismic instrumentation, the seismic switches of the plant are activated."

For most plants with seismic instrumentation, the seismic switches are set at an acceleration of about 0.01g. This EAL should be developed on site specific basis. The method of detection can be based on instrumentation, validated by a reliable source, or operator assessment.

The National Earthquake Center can confirm if an earthquake has occurred in the area of the plant.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU3 (continued)

EAL #2

This EAL is based on a tornado striking (touching down) or high winds within the PROTECTED AREA.

The high wind value should be based on site specific FSAR design basis as long as it is within the range of the instrumentation available for wind speed.

EAL #3

This EAL addresses the effect of internal flooding caused by events such as component failures, equipment misalignment, or outage activity mishaps.

The site specific areas include those areas that contain systems required for safe shutdown of the plant, which are not designed to be partially or fully submerged. The plant's IPEEE may provide insight into areas to be considered when developing this EAL.

EAL #4 and 5

This EAL addresses other site specific phenomena (such as hurricane, flood, or seiche) that can also be precursors of more serious events.

EAL #6

This EAL addresses main turbine rotating component failures of sufficient magnitude to cause observable damage to the turbine casing or to the seals of the turbine generator. Generator seal damage observed after generator purge does not meet the intent of this EAL because it did not impact normal operation of the plant.

Of major concern is the potential for leakage of combustible fluids (lubricating oils) and gases (hydrogen cooling) to the plant environs. Actual FIRES and flammable gas build up are appropriately classified via HU4, and HU5.

This EAL is consistent with the definition of an UNUSUAL EVENT while maintaining the anticipatory nature desired and recognizing the risk to non-safety related equipment.

Site Specific

Table H-1 lists areas that house equipment that is needed to ensure safe shutdown of the plant. Personnel access to those areas may be an important factor in monitoring and controlling equipment operability. Table H-1 includes structures that are in contact with or immediately adjacent to (directly impacts or obstructs) the areas that actually contain the equipment of concern.

EAL #1

This threshold is based on the strong-motion seismograph actuation level which is the sensed earthquake threshold of 0.01 g.

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU3 (continued)

EAL #2

The wind speed threshold is based on station structural wind load design criteria for a wind velocity of 80 mph at a nominal 30 feet above the ground (the "fastest mile" American Society of Civil Engineers estimation for a 100 year recurrence interval). This is considered ground level windspeed and is consistent with the 35 foot Meteorological sensor location.

Wind speed is obtained from meteorological data in the CONTROL ROOM that is averaged over a 15 minute period to prevent instantaneous wind gusts or fluctuations from affecting the measurement.

EAL #4

A river level greater than 705' mean sea level is consistent with the elevation of the main transformer pad. This river level will permit flooding to occur within the turbine building, although no safety related equipment is expected to be affected at this elevation.

Indicators to support this determination may include:

4) LR-1CW-101, Ohio River Water Level Recorder,
5) Intake Structure river level indication (ruler markings on outside of Intake Building), or
6) Montgomery Lock or National Weather Service reports Montgomery Lower Pool Level Gauge Reading > 52.48 Ft (equivalent to 705' MSL).

Note: Mean Sea Level = Lower Gauge Reading + 652.52 Ft.

Phone numbers to contact Montgomery Lock and the National Weather Service are located on Form 1/2-EPP-IP-1.1.F02.

EAL #5

At a river level of about 650' normal river water or service water pump (full-flow) into the intake bay will be greater than gravity-fed in-flow from the river itself, causing the intake bay water level to drop eventually resulting in intake pump low flow and reduced service life. When river level drops below 650', valves may be manually throttled to reduce pump flows in order to prevent a lowering level in the intake bay. The throttled cooling water at this river level will provide for decay heat removal and other normal operating pumps (i.e., charging), but cannot provide for containment coolers and other emergency event equipment. River water level below 650' constitutes a reduced margin of safety state due to cooling flow rates below normal.

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU3 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, HU1
2. BVPS-1 UFSAR Table A.1-1, Category I Structures, Systems, and Components, Rev 26
3. BVPS-1 UFSAR, Section 1.3.3.27, Ultimate Heat Sink (Safety Guide 27), Rev 26
4. BVPS-1 UFSAR Section 2.3.1.2, River Stage, Rev 26
5. BVPS-1 UFSAR Figure 2.5-5, Response Spectra 0.06g OBE (Based on Soil-Structure), Rev 26
6. BVPS-1 UFSAR Section 2.7.1.1, Seismic Category I Structures, Rev 26
7. 1/2OM-53C.4A.75.4, Acts of Nature, Dam Failure, Rev 7
8. N-779, BVPS Unit 1 and Unit 2 Response to a Dam Failure, Rev 1
9. Form 1/2-EPP-IP-1.1.F02
10. 1OM-45G.4.AAA, Seismic Accelograph Operation

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA4

INITIATING CONDITION:

FIRE or EXPLOSION affecting the operability of plant safety systems required to establish or maintain safe shutdown.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. FIRE or EXPLOSION resulting in **EITHER** of the following:
   - VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

Table H-1
• Cable Tunnel (CV-3) • CONTROL ROOM • Containment Building • Demin. Water Storage Tank (1WT-TK-10) • Diesel Generator Building • Fuel Building • Intake Structure Pump Cubicles • Safeguards (including AFW, Main Steam and Cable Vault Areas) • Primary Auxiliary Building (except elev. 768') • RWST (1QS-TK-1) • Service Building (below elev. 735')

Basis:

Generic

VISIBLE DAMAGE is used to identify the magnitude of the FIRE or EXPLOSION and to discriminate against minor FIRES and EXPLOSIONs.

The reference to structures containing safety systems or components is included to discriminate against FIRES or EXPLOSIONs in areas having a low probability of affecting safe operation. The significance here is not that a safety system was degraded but the fact that the FIRE or EXPLOSION was large enough to cause damage to these systems.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA4 (continued)

The use of VISIBLE DAMAGE should not be interpreted as mandating a lengthy damage assessment prior to classification. The declaration of an ALERT and the activation of the TECHNICAL SUPPORT CENTER will provide the EMERGENCY DIRECTOR with the resources needed to perform detailed damage assessments.

The EMERGENCY DIRECTOR also needs to consider any security aspects of the.

This EAL should specify site specific structures or areas that contain safety system, or component and functions required for safe shutdown of the plant. Site specific Safe Shutdown Analysis should be consulted for equipment and plant areas required to establish or maintain safe shutdown.

Site Specific

Table H-1 lists areas that house equipment that is needed to ensure safe shutdown of the plant. Personnel access to those areas may be an important factor in monitoring and controlling equipment operability.

A steam line break or steam EXPLOSION that damages permanent structures or equipment in one of these areas would be classified under this EAL.

Basis Reference(s):

1. NEI 99-01 Rev 5, HU2
2. U1 UFSAR Table A.1-1, Category I Structures, Systems, and Components, Rev. 26

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU4

INITIATING CONDITION:

FIRE within the PROTECTED AREA not extinguished within 15 minutes of detection or EXPLOSION within the PROTECTED AREA.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Notes:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the duration has exceeded, or will likely exceed, the applicable time.
- Immediately adjacent to applies to FIRES that directly impact or obstruct the areas of concern.

1. FIRE not extinguished within **15 minutes** of CONTROL ROOM notification or verification of a CONTROL ROOM FIRE alarm in actual contact with or immediately adjacent to **ANY** of the **Table H-1** areas.

Table H-1
• Cable Tunnel (CV-3)
• CONTROL ROOM
• Containment Building
• Demin. Water Storage Tank (1WT-TK-10)
• Diesel Generator Building
• Fuel Building
• Intake Structure Pump Cubicles
• Safeguards (including AFW, Main Steam and Cable Vault Areas)
• Primary Auxiliary Building (except elev. 768')
• RWST (1QS-TK-1)
• Service Building (below elev. 735')

OR

2. EXPLOSION within the PROTECTED AREA.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU4 (continued)

Basis:

Generic

This EAL addresses the magnitude and extent of FIRES or EXPLOSIONs that may be potentially significant precursors of damage to safety systems. It addresses the FIRE or EXPLOSION, and not the degradation in performance of affected systems that may result.

As used here, detection is visual observation and report by plant personnel or sensor alarm indication.

EAL #1

The 15 minute time period begins with a credible notification that a FIRE is occurring, or indication of a FIRE detection system alarm/actuation. Verification of a FIRE detection system alarm/actuation includes actions that can be taken within the CONTROL ROOM or other nearby site specific location to ensure that it is not spurious. An alarm is assumed to be an indication of a FIRE unless it is disproved within the 15 minute period by personnel dispatched to the scene. In other words, a personnel report from the scene may be used to disprove a sensor alarm if received within 15 minutes of the alarm, but shall not be required to verify the alarm.

The intent of this 15 minute duration is to size the FIRE and to discriminate against small FIRES that are readily extinguished (e.g., smoldering waste paper basket).

The site specific list should be limited and applies to buildings and areas in actual contact with or immediately adjacent to VITAL AREAS or other significant buildings or areas. The intent of this IC is not to include buildings (i.e., warehouses) or areas that are not in actual contact with or immediately adjacent to VITAL AREAS. This excludes FIRES within administration buildings, waste-basket FIRES, and other small FIRES of no safety consequence. Immediately adjacent implies that the area immediately adjacent contains or may contain equipment or cabling that could impact equipment located in VITAL AREAS or the FIRE could damage equipment inside VITAL AREAS or that precludes access to VITAL AREAS.

EAL #2

This EAL addresses only those EXPLOSIONS of sufficient force to damage permanent structures or equipment within the PROTECTED AREA.

No attempt is made to assess the actual magnitude of the damage. The occurrence of the EXPLOSION is sufficient for declaration.

The EMERGENCY DIRECTOR also needs to consider any security aspects of the EXPLOSION, if applicable.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU4 (continued)

Site Specific

Table H-1 lists areas that house equipment that is needed to ensure safe shutdown of the plant. Personnel access to those areas may be an important factor in monitoring and controlling equipment operability. Table H-1 includes structures that are in contact with or immediately adjacent to (directly impacts or obstructs) the areas that actually contain the equipment of concern.

For the purposes of declaring an emergency event, the term "extinguished" means no visible flames.

A steam line break or steam EXPLOSION that damages permanent structures or equipment in a PROTECTED AREA would be classified under this EAL.

Basis Reference(s):

1. NEI 99-01 Rev 5, HU2
2. U1 UFSAR Table A.1-1, Category I Structures, Systems, and Components, Rev. 26

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA5

INITIATING CONDITION:

Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of operable equipment required to maintain safe operations or safely shutdown the reactor.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Notes:

- If the equipment in the stated area was already inoperable, or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event.
- This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area.

1. Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of systems required to maintain safe operations or safely shutdown the reactor.

Basis:

Generic

Gases in a VITAL AREA can affect the ability to safely operate or safely shutdown the reactor.

The fact that SCBA may be worn does not eliminate the need to declare the event.

Declaration should not be delayed for confirmation from atmospheric testing if the atmosphere poses an immediate threat to life and health or an immediate threat of severe exposure to gases. This could be based upon documented analysis, indication of personnel ill effects from exposure, or operating experience with the hazards.

If the equipment in the stated area is already inoperable or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event.

This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA5 (continued)

An asphyxiant is a gas capable of reducing the level of oxygen in the body to dangerous levels. Most commonly, asphyxiants work by merely displacing air in an enclosed environment. This reduces the concentration of oxygen below the normal level of around 19%, which can lead to breathing difficulties, unconsciousness or even death.

An uncontrolled release of flammable gasses within a facility structure has the potential to affect safe operation of the plant by limiting either operator or equipment operations due to the potential for ignition and resulting equipment damage/personnel injury. Flammable gases, such as hydrogen and acetylene, are routinely used to maintain plant systems (hydrogen) or to repair equipment/components (acetylene - used in welding). This EAL assumes concentrations of flammable gasses which can ignite/support combustion.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HA3
2. NEI 99-01 Rev 5, FAQ# 24

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU5

INITIATING CONDITION:

Release of toxic, corrosive, asphyxiant or flammable gases deemed detrimental to NORMAL PLANT OPERATIONS.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Note: This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area.

1. Toxic, corrosive, asphyxiant or flammable gases in amounts that have or could adversely affect NORMAL PLANT OPERATIONS.

   OR

2. Report by local, county or state officials for evacuation or sheltering of site personnel based on an OFFSITE event.

Basis:

Generic

This EAL is based on the release of toxic, corrosive, asphyxiant or flammable gases of sufficient quantity to affect NORMAL PLANT OPERATIONS.

The fact that SCBA may be worn does not eliminate the need to declare the event.

This IC is not intended to require significant assessment or quantification. It assumes an uncontrolled process that has the potential to affect plant operations. This would preclude small or incidental releases, e.g. handheld FIRE extinguishers, or releases that do not impact structures needed for plant operation.

This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area.

An asphyxiant is a gas capable of reducing the level of oxygen in the body to dangerous levels. Most commonly, asphyxiants work by merely displacing air in an enclosed environment. This reduces the concentration of oxygen below the normal level of around 19%, which can lead to breathing difficulties, unconsciousness or even death.

Site Specific

None

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU5 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, HU3
2. NEI 99-01 Rev 5, FAQ# 24

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HG6

INITIATING CONDITION:

Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of a GENERAL EMERGENCY.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PROTECTIVE ACTION GUIDE exposure levels OFFSITE for more than the immediate site area.

Basis:

Generic

This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the EMERGENCY DIRECTOR to fall under the EMERGENCY CLASSIFICATION LEVEL description for GENERAL EMERGENCY.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HG2
2. EPA-400, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HS6

INITIATING CONDITION:

Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of a SITE AREA EMERGENCY.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts: (1) toward site personnel or equipment that could lead to the likely failure of or; (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PROTECTIVE ACTION GUIDE exposure levels beyond the site boundary.

Basis:

Generic

This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the EMERGENCY DIRECTOR to fall under the EMERGENCY CLASSIFICATION LEVEL description for SITE AREA EMERGENCY.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HS3
2. EPA-400, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA6

INITIATING CONDITION:

Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an ALERT.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA PROTECTIVE ACTION GUIDE exposure levels.

Basis:

Generic

This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the EMERGENCY DIRECTOR to fall under the ALERT EMERGENCY CLASSIFICATION LEVEL.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HA6
2. EPA-400, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU6

INITIATING CONDITION:

Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an UNUSUAL EVENT.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring OFFSITE response or monitoring are expected unless further degradation of safety systems occurs.

Basis:

Generic

This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the EMERGENCY DIRECTOR to fall under the UNUSUAL EVENT EMERGENCY CLASSIFICATION LEVEL.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HU5

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

E-HU1

INITIATING CONDITION:

Damage to a loaded cask CONFINEMENT BOUNDARY.

Operating Mode Applicability:

Not Applicable

EALs:

1. Damage to a loaded cask CONFINEMENT BOUNDARY.

Basis:

Generic

An UNUSUAL EVENT in this IC is categorized on the basis of the occurrence of an event of sufficient magnitude that a loaded cask CONFINEMENT BOUNDARY is damaged or violated. This includes classification based on a loaded fuel storage cask CONFINEMENT BOUNDARY loss leading to the degradation of the fuel during storage or posing an operational safety problem with respect to its removal from storage.

The results of the ISFSI Safety Analysis Report (SAR) per NUREG 1536 or SAR referenced in the cask's Certificate of Compliance and the related NRC Safety Evaluation Report identify natural phenomena events and accident conditions that could potentially affect the CONFINEMENT BOUNDARY. This EAL addresses a dropped cask, a tipped over cask, EXPLOSION, PROJECTILE damage, FIRE damage or natural phenomena affecting a cask (e.g., seismic event, tornado, etc.).

Site Specific

None.

Basis Reference(s):

1. NEI 99-01 Rev 5, E-HU1

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SG1

INITIATING CONDITION:

Prolonged loss of all OFFSITE and all ONSITE AC power to emergency busses.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

1. a. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses.

   AND

   b. **EITHER** of the following:

   - Restoration of **EITHER** the AE 4KV emergency bus **OR** DF 4KV emergency bus within **4 hours** is not likely.
   - Core Cooling - Red entry conditions met.

Basis:

<u>Generic</u>

Loss of all AC power to emergency busses compromises all plant safety systems requiring electric power including RHR, ECCS, Containment Heat Removal, and the Ultimate Heat Sink. Prolonged loss of all AC power to emergency busses will lead to loss of fuel clad, RCS, and containment, thus warranting declaration of a GENERAL EMERGENCY.

The hours to restore AC power can be based on a site blackout coping analysis performed in conformance with 10 CFR 50.63 and Regulatory Guide 1.155, "Station Blackout," as available. Appropriate allowance for OFFSITE emergency response including evacuation of surrounding areas should be considered. Although this IC may be viewed as redundant to the Fission Product Barrier Degradation IC, its inclusion is necessary to better assure timely recognition and emergency response.

This IC is specified to assure that in the unlikely event of a prolonged station blackout, timely recognition of the seriousness of the event occurs and that declaration of a GENERAL EMERGENCY occurs as early as is appropriate, based on a reasonable assessment of the event trajectory.

The likelihood of restoring at least one emergency bus should be based on a realistic appraisal of the situation since a delay in an upgrade decision based on only a chance of mitigating the event could result in a loss of valuable time in preparing and implementing public PROTECTIVE ACTIONS.

In addition, under these conditions, Fission Product Barrier monitoring capability may be degraded.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SG1 (continued)

Site Specific

OFFSITE AC power is considered AC power supplied from the grid.

A cross-tie connecting the 4,160 V normal busses 1A and 1D of BVPS-1, and 2A and 2D of BVPS-2 provides the capability to provide limited power to the emergency busses at one unit from either of the emergency diesel generators (EDGs) at the other unit.

In conformance with the SBO Rule 10 CFR 50.63, BVPS utilizes the EDGs at each unit as an alternate AC (AAC) power source to operate systems necessary for the required SBO coping duration and recovery therefrom. With the cross-tie, BVPS can cope with a postulated total loss of OFFSITE power to both units coincident with the loss of all ONSITE power (EDGs) at one unit, by enabling any single available EDG at either unit to supply power to the required SBO loads at both units within one hour.

The design of the SBO cross-tie circuit conforms with guidance provided by Regulatory Guide 1.155 and NUMARC 87-00. The circuit consists of four locally operated 4,160 V breakers installed at switchgear busses 1A, 1D, 2A, and 2D, and interconnected by 5 kv power cables protected against the effects of likely weather-related events. The normal to emergency 4,160 V bus connections and the EDG to emergency 4,160 V bus connections, described in BVPS-1 UFSAR Section 8.5.2, complete the circuit to the AAC.

Basis Reference(s):

1. NEI 99-01 Rev 5, SG1
2. U1 UFSAR Section 8.4.6, Station Blackout (SBO) 4,160 V Cross-Tie, Rev 26
3. DEC-0248, Coping Duration for Station Black Out, Rev 0

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS1

INITIATING CONDITION:

Loss of all OFFSITE and all ONSITE AC power to emergency busses for 15 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Notes:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.
- Credit cannot be taken for emergency busses being powered from the other unit's emergency diesel generators.

1. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes** or longer.

Basis:

Generic

Loss of all AC power to emergency busses compromises all plant safety systems requiring electric power including RHR, ECCS, Containment Heat Removal and the Ultimate Heat Sink. Prolonged loss of all AC power to emergency busses will lead to loss of fuel clad, RCS, and containment, thus this event can escalate to a GENERAL EMERGENCY.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of OFFS!TE power.

At multi-unit stations, the EALs should allow credit for operation of installed design features, such as cross-ties or swing diesels, provided that abnormal or EMERGENCY OPERATING PROCEDURES address their use. However, these stations must also consider the impact of this condition on other shared safety functions in developing the site specific EAL.

Plants that have a proceduralized capability to cross-tie AC power from an OFFSITE power supply of a companion unit may take credit for the redundant power source in the associated EAL for this IC.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS1 (continued)

Site Specific

OFFSITE AC power is considered AC power supplied from the grid.

A cross-tie connecting the 4,160 V normal busses 1A and 1D of BVPS-1, and 2A and 2D of BVPS-2 provides the capability to provide limited power to the emergency busses at one unit from either of the emergency diesel generators (EDGs) at the other unit.

In conformance with the SBO Rule 10 CFR 50.63, BVPS utilizes the EDGs at each unit as an alternate AC (AAC) power source to operate systems necessary for the required SBO coping duration and recovery therefrom. With the cross-tie, BVPS can cope with a postulated total loss of OFFSITE power to both units coincident with the loss of all ONSITE power (EDGs) at one unit, by enabling any single available EDG at either unit to supply power to the required SBO loads at both units within one hour.

The design of the SBO cross-tie circuit conforms with guidance provided by Regulatory Guide 1.155 and NUMARC 87-00. The circuit consists of four locally operated 4,160 V breakers installed at switchgear busses 1A, 1D, 2A, and 2D, and interconnected by 5 kv power cables protected against the effects of likely weather-related events. The normal to emergency 4,160 V bus connections and the EDG to emergency 4,160 V bus connections, described in BVPS-1 UFSAR Section 8.5.2, complete the circuit to the AAC.

Credit cannot be taken for emergency busses being powered from the other unit's emergency diesel generators.

Basis Reference(s):

1. NEI 99-01 Rev 5, SS1
2. U1 UFSAR Section 8.4.6, Station Blackout (SBO) 4,160 V Cross-Tie, Rev 26
3. DEC-0248, Coping Duration for Station Black Out, Rev 0

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SA1

INITIATING CONDITION:

AC power capability to emergency busses reduced to a single source for 15 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. a. AC power to AE and DF 4KV emergency busses is reduced to a single power source for **15 minutes** or longer.

   AND

   b. Any additional single power source failure will result in loss of **ALL** AC power to **BOTH** AE and DF 4KV emergency busses.

Basis:

Generic

The condition indicated by this IC is the degradation of the OFFSITE and ONSITE AC power systems such that any additional single failure would result in a loss of all AC power to emergency buses. This condition could occur due to a loss of OFFSITE power with a concurrent failure of all but one emergency generator to supply power to its emergency busses. Another related condition could be the loss of all OFFSITE power and loss of ONSITE emergency generators with only one train of emergency busses being backfed from the unit main generator, or the loss of ONSITE emergency generators with only one train of emergency busses being backfed from OFFSITE power.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of power.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, SA5
2. NEI 99-01 Rev 5, FAQ# 36

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU1

INITIATING CONDITION:

Loss of all OFFSITE AC power to emergency busses for 15 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

1. Loss of **ALL** OFFSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes** or longer.

Basis:

Generic

Prolonged loss of OFFSITE AC power reduces required redundancy and potentially degrades the level of safety of the plant by rendering the plant more vulnerable to a complete loss of AC power to emergency busses.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of OFFSITE power.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, SU1

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS2

INITIATING CONDITION:

Loss of all vital DC power for 15 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

1. Bus voltage indication on **ALL** safety related DC busses less than the following for **15 minutes** or longer:
   - **< 110.4 VDC** on Busses 1-1 and 1-2
   - **< 110.0 VDC** on Busses 1-3 and 1-4

Basis:

Generic

Loss of all DC power compromises ability to monitor and control plant safety functions. Prolonged loss of all DC power will cause core uncovering and loss of containment integrity when there is significant decay heat and sensible heat in the reactor system.

Site specific bus voltage should be based on the minimum bus voltage necessary for the operation of safety related equipment. This voltage value should incorporate a margin of at least 15 minutes of operation before the onset of inability to operate those loads. This voltage is usually near the minimum voltage selected when battery sizing is performed. Typically the value for the entire battery set is approximately 105 VDC. For a 60 cell string of batteries the cell voltage is typically 1.75 Volts per cell. For a 58 string battery set the minimum voltage is typically 1.81 Volts per cell.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Site Specific

The 125 VDC and 120 VAC Vital Bus Systems are designed to provide redundant and reliable power to components and systems that are essential to plant safety, including the Reactor Protective System (RPS) and the Engineered Safety Feature Actuation System (ESFAS) (Technical Specification Bases 3.8.8).

The station batteries supply essential and nonessential 125 VDC loads and distribution panels during a loss of the battery charger supply. The batteries are sized to supply the station DC and AC vital bus loads for a period of 2 hours without AC power (UFSAR Section 8.5.3).

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS2 (continued)

The 60 cell station batteries [BAT-1-1 & -2] have a minimum design end of battery cycle voltage of 110.4 VDC, which is equivalent to an average of 1.84 volts per cell (1DBD-39 & UFSAR 8.5.3).

The 59 cell station batteries [BAT-1-3 & -4] have a minimum design end of battery cycle voltage of 110.0 VDC, which is equivalent to an average of 1.864 volts per cell (1DBD-39 & UFSAR 8.5.3).

Basis Reference(s):

1. NEI 99-01 Rev 5, SS3
2. U1 UFSAR, Section 8.5.3, 125 V D-C Power System, Rev 26
3. BVPS-1 & 2 Technical Specification Bases 3.8.5, DC Sources – Shutdown, Rev 0
4. BVPS-1 & 2 Technical Specification Bases 3.8.8, Inverters – Shutdown, Rev 0
5. 1DBD-39, Design Basis Document for 125 VDC Power System, Rev 6

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SG3

INITIATING CONDITION:

Automatic trip and all manual actions failed to shutdown the reactor and indication of an extreme challenge to the ability to cool the core exists.

Operating Mode Applicability:

1, 2

EALs:

1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power > **5%**.

   AND

   b. **ALL** manual trip actions failed to shutdown the reactor as indicated by reactor power > **5%**.

   AND

   c. **EITHER** of the following has occurred:

   - Core Cooling - Red entry conditions met.
   - Heat Sink - Red entry conditions met.

Basis:

Generic

Under these conditions, the reactor is producing more heat than the maximum decay heat load for which the safety systems are designed and efforts to bring the reactor subcritical are unsuccessful.

The reactor should be considered shutdown when it is producing less heat than the maximum decay heat load for which the safety systems are designed (typically 3 to 5% power). For plants using CSFSTs, this EAL equates to the criteria used to determine a VALID Subcriticality Red Path.

For PWRs, the extreme challenge to the ability to cool the core is intended to mean that the core exit temperatures are at or approaching 1200° F or that the reactor vessel water level is below the top of active fuel. For plants using CSFSTs, this EAL equates to a Core Cooling Red condition combined with a Subcriticality Red condition.

Another consideration is the inability to initially remove heat during the early stages of this sequence. For PWRs, if emergency feedwater flow is insufficient to remove the amount of heat required by design from at least one steam generator, an extreme challenge should be considered to exist. For plants using CSFSTs, this EAL equates to a Heat Sink Red condition combined with a Subcriticality Red condition.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SG3 (continued)

In the event either of these challenges exists at a time that the reactor has not been brought below the power associated with the safety system design a core melt sequence exists. In this situation, core degradation can occur rapidly. For this reason, the GENERAL EMERGENCY declaration is intended to be anticipatory of the fission product barrier table declaration to permit maximum OFFSITE intervention time.

Site Specific

This EAL considers all actions to trip the reactor at and away from the reactor control console.

Basis Reference(s):

1. NEI 99-01 Rev 5, SG2
2. NEI 99-01 Rev 5, FAQ# 31

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS3

INITIATING CONDITION:

Automatic trip and manual actions taken within the Controls Area (CA) failed to shutdown the reactor.

Operating Mode Applicability:

1, 2

EALs:

1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power **> 5%**.

   AND

   b. Manual trip actions taken within the Controls Area (CA) failed to shutdown the reactor as indicated by reactor power **> 5%**.

Basis:

Generic

Under these conditions, the reactor is producing more heat than the maximum decay heat load for which the safety systems are designed and efforts to bring the reactor subcritical are unsuccessful. A SITE AREA EMERGENCY is warranted because conditions exist that lead to IMMINENT loss or potential loss of both fuel clad and RCS.

The reactor should be considered shutdown when it is producing less heat than the maximum decay heat load for which the safety systems are designed (typically 3 to 5% power). For plants using CSFSTs, this EAL equates to the criteria used to determine a VALID Subcriticality Red Path.

Manual scram (trip) actions taken at the reactor control console are any set of actions by the reactor operator(s) at which causes or should cause control rods to be rapidly inserted into the core and shuts down the reactor.

Manual scram (trip) actions are not considered successful if action away from the reactor control console is required to scram (trip) the reactor. This EAL is still applicable even if actions taken away from the reactor control console are successful in shutting the reactor down because the design limits of the fuel may have been exceeded or because of the gross failure of the Reactor Protection System to shutdown the plant.

Site Specific

None

SS3 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, SS2
2. NEI 99-01 Rev 5, FAQ# 31

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SA3

INITIATING CONDITION:

Automatic trip failed to shutdown the reactor and the manual actions taken from the Controls Area (CA) are successful in shutting down the reactor.

Operating Mode Applicability:

1, 2

EALs:

1. a. An automatic reactor trip failed to shutdown the reactor.

   AND

   b. Manual trip actions taken within the Controls Area (CA) successfully shutdown the reactor as indicated by reactor power **≤ 5%.**

Basis:

Generic

The reactor should be considered shutdown when it is producing less heat than the maximum decay heat load for which the safety systems are designed (typically 3 to 5% power). For plants using CSFSTs, this EAL equates to the criteria used to determine a VALID Subcriticality Red Path.

Manual scram (trip) actions taken at the reactor control console are any set of actions by the reactor operator(s) which causes or should cause control rods to be rapidly inserted into the core and shuts down the reactor.

If the manual scram (trip) switches/pushbuttons on the CONTROL ROOM console panels are considered an automatic input into the Reactor Protection System, a failure to scram (trip) without any other automatic input would make this threshold applicable.

This condition indicates failure of the automatic protection system to scram (trip) the reactor. This condition is more than a potential degradation of a safety system in that a front line automatic protection system did not function in response to a scram (trip) signal. Thus the plant safety has been compromised because design limits of the fuel may have been exceeded. An ALERT is indicated because conditions may exist that lead to potential loss of fuel clad or RCS and because of the failure of the Reactor Protection System to automatically shutdown the plant.

Site Specific

None

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SA3 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, SA2
2. NEI 99-01 Rev 5, FAQ#s 31 and 35

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU3

INITIATING CONDITION:

Inadvertent criticality.

Operating Mode Applicability:

3, 4

EALs:

1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.

Basis:

Generic

This IC addresses inadvertent criticality events. This IC indicates a potential degradation of the level of safety of the plant, warranting an UNUSUAL EVENT EMERGENCY CLASSIFICATION LEVEL. This IC excludes inadvertent criticalities that occur during planned reactivity changes associated with reactor startups (e.g., criticality earlier than estimated).

This condition can be identified using the startup rate monitor. The term "sustained" is used in order to allow exclusion of expected short term positive startup rates from planned control rod movements (such as shutdown bank withdrawal). These short term positive startup rates are the result of the increase in neutron population due to subcritical multiplication.

Site Specific

This condition can be identified using:

- Source Range Detectors N-31 & N-32
- Intermediate Range Detectors N-35 & N-36
- Scaler Timer N-34 (Audible Count Rate)

Basis Reference(s):

1. NEI 99-01 Rev 5, SU8
2. Regulatory Guide 8.12, Criticality Accident Alarm Systems

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS4

INITIATING CONDITION:

Inability to monitor a significant transient in progress.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. a. Loss of **> 75%** of **EITHER** of the following for **15 minutes** or longer:

- CONTROL ROOM Annunciator Panels (A1 - A13).

OR

- CONTROL ROOM critical safety function indications (Table S-1).

Table S-1: Critical Safety Functions
• Reactivity Control (ability to shut down the reactor and keep it shut down)
• RCS inventory (ability to cool the core)
• Secondary heat removal (ability to maintain a heat sink)

AND

b. A **Table S-2** significant transient is in progress.

Table S-2: Significant Transients
• Automatic turbine runback > 25% thermal reactor power
• Electrical load rejection > 25% full electrical load
• Reactor trip
• Safety Injection actuation

AND

c. COMPENSATORY INDICATIONS are unavailable.

SS4 (continued)

Basis:

Generic

This IC is intended to recognize the threat to plant safety associated with the complete loss of capability of the CONTROL ROOM staff to monitor plant response to a significant transient.

"Planned" and "UNPLANNED" actions are not differentiated since the loss of instrumentation of this magnitude is of such significance during a transient that the cause of the loss is not an ameliorating factor.

Quantification is arbitrary, however, it is estimated that if approximately 75% of the safety system annunciators or indicators are lost, there is an increased risk that a degraded plant condition could go undetected. It is not intended that plant personnel perform a detailed count of the instrumentation lost but use the value as a judgment threshold for determining the severity of the plant conditions. It is also not intended that the Shift Supervisor be tasked with making a judgment decision as to whether additional personnel are required to provide increased monitoring of system operation.

It is further recognized that most plant designs provide redundant safety system indication powered from separate uninterruptible power supplies. While failure of a large portion of annunciators is more likely than a failure of a large portion of indications, the concern is included in this EAL due to difficulty associated with assessment of plant conditions. The loss of specific, or several, safety system indicators should remain a function of that specific system or component operability status. This will be addressed by the specific Technical Specification. The initiation of a Technical Specification imposed plant shutdown related to the instrument loss will be reported via 10 CFR 50.72. If the shutdown is not in compliance with the Technical Specification action, the UNUSUAL EVENT is based on SU5, "Inability to Reach Required Shutdown Within Technical Specification Limits."

A SITE AREA EMERGENCY is considered to exist if the CONTROL ROOM staff cannot monitor safety functions needed for protection of the public while a significant transient is in progress.

Site specific annunciators for this EAL should be limited to include those identified in the Abnormal Operating Procedures, in the EMERGENCY OPERATING PROCEDURES, and in other EALs (e.g., area, process, and/or effluent rad monitors, etc.)

Site specific indications needed to monitor safety functions necessary for protection of the public must include CONTROL ROOM indications, computer generated indications and dedicated annunciation capability.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS4 (continued)

The specific indications should be those used to determine such functions as the ability to shut down the reactor, maintain the core cooled, to maintain the Reactor Coolant System intact, maintain the spent fuel cooled, and to maintain containment intact.

A significant transient is an UNPLANNED event involving one or more of the following site specific criteria: (1) automatic turbine runback greater than 25% thermal reactor power, (2) electrical load rejection greater than 25% full electrical load, (3) Reactor trip, or (4) Safety Injection activation.

COMPENSATORY INDICATIONS in this context include computer based information such as SPDS. This should include all computer systems available for this use depending on specific plant design and subsequent retrofits.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Site Specific

CONTROL ROOM safety system annunciators are provided on annunciator panels A1 through A13.

Basis Reference(s):

1. NEI 99-01 Rev 5, SS6
2. NEI 99-01 Rev 5, FAQ# 39

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SA4

INITIATING CONDITION:

Loss of safety system annunciation or indication in the CONTROL ROOM with either: (1) a significant transient in progress, or (2) COMPENSATORY INDICATIONS are unavailable.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. a. Loss of **> 75%** of **EITHER** of the following for **15 minutes** or longer:
   - CONTROL ROOM Annunciator Panels (A1 - A13).

   OR

   - CONTROL ROOM critical safety function indications (Table S-1).

Table S-1: Critical Safety Functions
• Reactivity Control (ability to shut down the reactor and keep it shut down)
• RCS inventory (ability to cool the core)
• Secondary heat removal (ability to maintain a heat sink)

   AND

   b. **EITHER** of the following:
   - A **Table S-2** significant transient is in progress.

Table S-2: Significant Transients
• Automatic turbine runback > 25% thermal reactor power
• Electrical load rejection > 25% full electrical load
• Reactor trip
• Safety Injection actuation

   OR

   - COMPENSATORY INDICATIONS are unavailable.

SA4 (continued)

Basis:

Generic

This IC is intended to recognize the difficulty associated with monitoring changing plant conditions without the use of a major portion of the annunciation or indication equipment during a significant transient.

Recognition of the availability of computer based indication equipment is considered (e.g., SPDS, plant computer, etc.).

Quantification is arbitrary, however, it is estimated that if approximately 75% of the safety system annunciators or indicators are lost, there is an increased risk that a degraded plant condition could go undetected. It is not intended that plant personnel perform a detailed count of the instrumentation lost but use the value as a judgment threshold for determining the severity of the plant conditions. It is also not intended that the Shift Supervisor be tasked with making a judgment decision as to whether additional personnel are required to provide increased monitoring of system operation.

It is further recognized that most plant designs provide redundant safety system indication powered from separate uninterruptible power supplies. While failure of a large portion of annunciators is more likely than a failure of a large portion of indications, the concern is included in this EAL due to difficulty associated with assessment of plant conditions. The loss of specific, or several, safety system indicators should remain a function of that specific system or component operability status. This will be addressed by the specific Technical Specification. The initiation of a Technical Specification imposed plant shutdown related to the instrument loss will be reported via 10 CFR 50.72. If the shutdown is not in compliance with the Technical Specification action, the UNUSUAL EVENT is based on SU5, "Inability to Reach Required Operating Mode Within Technical Specification Limits."

Site specific annunciators or indicators for this EAL must include those identified in the Abnormal Operating Procedures, in the EMERGENCY OPERATING PROCEDURES, and in other EALs (e.g., area, process, and/or effluent rad monitors, etc.).

A significant transient is an UNPLANNED event involving one or more of the following site specific criteria: (1) automatic turbine runback greater than 25% thermal reactor power, (2) electrical load rejection greater than 25% full electrical load, (3) Reactor trip, or (4) Safety Injection activation.

COMPENSATORY INDICATIONS in this context include computer based information such as SPDS. This should include all computer systems available for this use depending on specific plant design and subsequent retrofits. If both a major portion of the annunciation system and all computer monitoring are unavailable, the ALERT is required.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SA4 (continued)

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Site Specific

CONTROL ROOM safety system annunciators are provided on annunciator panels A1 through A13.

Basis Reference(s):

1. NEI 99-01 Rev 5, SA4
2. NEI 99-01 Rev 5, FAQ# 39

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU4

INITIATING CONDITION:

Loss of safety system annunciation or indication in the CONTROL ROOM for 15 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

1. Loss of **> 75%** of **EITHER** of the following for **15 minutes** or longer:
   - CONTROL ROOM Annunciator Panels (A1 - A13).

   OR

   - CONTROL ROOM critical safety function indications (Table S-1).

Table S-1: Critical Safety Functions
• Reactivity Control (ability to shut down the reactor and keep it shut down)
• RCS inventory (ability to cool the core)
• Secondary heat removal (ability to maintain a heat sink)

Basis:

Generic

This IC and its associated EAL are intended to recognize the difficulty associated with monitoring changing plant conditions without the use of a major portion of the annunciation or indication equipment.

Recognition of the availability of computer based indication equipment is considered (e.g., SPDS, plant computer, etc.).

"Planned" loss of annunciators or indicators includes scheduled maintenance and testing activities.

Quantification is arbitrary, however, it is estimated that if approximately 75% of the safety system annunciators or indicators are lost, there is an increased risk that a degraded plant condition could go undetected. It is not intended that plant personnel perform a detailed count of the instrumentation lost but use the value as a judgment threshold for determining the severity of the plant conditions.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU4 (continued)

It is further recognized that most plant designs provide redundant safety system indication powered from separate uninterruptible power supplies. While failure of a large portion of annunciators is more likely than a failure of a large portion of indications, the concern is included in this EAL due to difficulty associated with assessment of plant conditions. The loss of specific, or several, safety system indicators should remain a function of that specific system or component operability status. This will be addressed by the specific Technical Specification. The initiation of a Technical Specification imposed plant shutdown related to the instrument loss will be reported via 10CFR50.72. If the shutdown is not in compliance with the Technical Specification action, the UNUSUAL EVENT is based on SU5, "Inability to Reach Required Operating Mode Within Technical Specification Limits."

Site specific annunciators or indicators for this EAL must include those identified in the Abnormal Operating Procedures, in the EMERGENCY OPERATING PROCEDURES, and in other EALs (e.g., area, process, and/or effluent rad monitors, etc.).

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Site Specific

CONTROL ROOM safety system annunciators are provided on annunciator panels A1 through A13.

Basis Reference(s):

1. NEI 99-01 Rev 5, SU3

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU5

INITIATING CONDITION:

Inability to reach required operating mode within Technical Specification limits.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

1. Plant is not brought to required operating mode within Technical Specification LCO action statement time.

Basis:

Generic

Limiting Conditions for Operation (LCOs) require the plant to be brought to a required operating mode when the Technical Specification required configuration cannot be restored. Depending on the circumstances, this may or may not be an emergency or precursor to a more severe condition. In any case, the initiation of plant shutdown required by the site Technical Specifications requires a four hour report under 10 CFR 50.72 (b), Non-emergency events.

The plant is within its safety envelope when being shut down within the allowable action statement time in the Technical Specifications. An immediate UNUSUAL EVENT is required when the plant is not brought to the required operating mode within the allowable action statement time in the Technical Specifications. Declaration of an UNUSUAL EVENT is based on the time at which the LCO specified action statement time period elapses under the site Technical Specifications and is not related to how long a condition may have existed.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, SU2

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU6

INITIATING CONDITION:

Loss of all ONSITE or OFFSITE communications capabilities.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

1. Loss of **ALL** of the following ONSITE communication methods affecting the ability to perform routine operations:
   - Radios.
   - Plant page.
   - Plant telephone System (hardwired).

   OR

2. Loss of **ALL** of the following OFFSITE communications methods affecting the ability to perform OFFSITE notifications:
   - NRC Emergency Notification System – ENS (Red Phone).
   - NRC Health Physics Network – HPN.
   - Commercial telephones (hardwired and wireless).

Basis:

Generic

The purpose of this IC and its associated EALs is to recognize a loss of communications capability that either defeats the plant operations staff ability to perform routine tasks necessary for plant operations or the ability to communicate issues with OFFSITE authorities.

The loss of OFFSITE communications ability is expected to be significantly more comprehensive than the condition addressed by 10 CFR 50.72.

The availability of one method of ordinary OFFSITE communications is sufficient to inform Federal, State, and local authorities of plant problems. This EAL is intended to be used only when extraordinary means (e.g., relaying of information from non-routine radio transmissions, individuals being sent to OFFSITE locations, etc.) are being used to make communications possible.

Site specific list for ONSITE communications loss must encompass the loss of all means of communications (e.g., commercial telephones, sound powered phone systems, plant page systems and radios) routinely used for operations.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU6 (continued)

Site specific list for OFFSITE communications loss must encompass the loss of all means of communications with OFFSITE authorities. This should include the ENS, commercial telephone lines, telecopy transmissions, and dedicated phone systems that are routinely used for OFFSITE emergency notifications.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, SU6

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU7

INITIATING CONDITION:

RCS leakage.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note:

- Identified, unidentified and pressure boundary RCS leakage as defined by Technical Specifications.
- Relief valve normal operation should be excluded unless it fails to close and cannot be isolated.

1. Unidentified or pressure boundary leakage **> 10 gpm.**

   OR

2. Identified leakage **> 25 gpm.**

Basis:

Generic

This IC is included as an UNUSUAL EVENT because it may be a precursor of more serious conditions and, as result, is considered to be a potential degradation of the level of safety of the plant. The 10 gpm value for the unidentified or pressure boundary leakage was selected as it is observable with normal CONTROL ROOM indications. Lesser values must generally be determined through time-consuming surveillance tests (e.g., mass balances).

Relief valve normal operation should be excluded from this IC. However, a relief valve that operates and fails to close per design should be considered applicable to this IC if the relief valve cannot be isolated.

The EAL for identified leakage is set at a higher value due to the lesser significance of identified leakage in comparison to unidentified or pressure boundary leakage.

Site Specific

Technical Specifications identifies the specific leakage location that qualifies as RCS leakage and provides the definitions for identified, unidentified and pressure boundary leakage.

Isolating letdown is a standard abnormal operating procedure action and may prevent unnecessary classifications when a non-RCS leakage path such as a CVCS leak exists.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU7 (continued)

Added generic basis Note for relief valve operation.

Basis Reference(s):

1. NEI 99-01 Rev 5, SU5
2. BVPS-1&2 Technical Specification 1.1, Definitions
3. BVPS-1&2 Technical Specification 3.4.13, RCS Operational Leakage

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU9

INITIATING CONDITION:

Fuel clad degradation.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

1. Letdown Monitor (RM-1CH-101A or B) **> 6.0E+04 cpm.**

   OR

2. RCS activity **> 21 µCi/gm** dose equivalent I-131.

Basis:

Generic

This EAL is included because it is a precursor of more serious conditions and, as result, is considered to be a potential degradation of the level of safety of the plant.

EAL #1

This threshold addresses site specific radiation monitor readings that provide indication of a degradation of fuel clad integrity.

EAL #2

This threshold addresses coolant samples exceeding coolant Technical Specifications for transient iodine spiking limits.

Site Specific

EAL #1

This reading is not applicable if letdown is isolated since the monitor isolates with letdown. As such, this reading would be useful only in those events (e.g., RCP locked rotor) in which safety injection and containment isolation do not actuate.

The RM-1CH-101 A/B calculated EAL value of 58,000 cpm has been rounded to 60,000 cpm based on accuracy of the analog instrument display capability. 60,000 cpm is the closest visually distinguishable reading to the derived EAL value. Instrument markings that bound the calculated EAL value are 40,000 and 60,000 cpm.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU9 (continued)

EAL #2

An UNUSUAL EVENT is only warranted when actual fuel clad damage is the cause of the elevated coolant sample (as determined by laboratory confirmation). However, fuel clad damage should be assumed to be the cause of elevated RCS activity unless another cause is known, e.g., RCS chemical decontamination evolution during shutdown results in high activity levels. This EAL and its associated applicability are based on Technical Specifications.

Basis Reference(s):

1. NEI 99-01 Rev 5, SU4
2. BVPS-1&2 Technical Specification 3.4.16, RCS Specific Activity
3. ERS-JTL-99-005, Unit 1 Letdown Radiation Monitor (RM-CH-101) Alarm Setpoint, Rev 3

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CA1

INITIATING CONDITION:

Loss of all OFFSITE and all ONSITE AC power to emergency busses for 15 minutes or longer.

Operating Mode Applicability:

5, 6, D

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes** or longer.

Basis:

Generic

Loss of all AC power compromises all plant safety systems requiring electric power including Residual Heat Removal, ECCS, Containment Heat Removal, Spent Fuel Heat Removal and the Ultimate Heat Sink.

The event can be classified as an ALERT when in cold shutdown, refueling, or defueled mode because of the significantly reduced decay heat and lower temperature and pressure, increasing the time to restore one of the emergency busses, relative to that specified for the SITE AREA EMERGENCY EAL.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, CA3

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU1

INITIATING CONDITION:

AC power capability to emergency busses reduced to a single source for 15 minutes or longer.

Operating Mode Applicability:

5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. a. AC power to AE and DF 4KV emergency busses is reduced to a single power source for **15 minutes** or longer.

   AND

   b. Any additional single power source failure will result in loss of **ALL** AC power to **BOTH** AE and DF 4KV emergency busses.

Basis:

Generic

The condition indicated by this IC is the degradation of the OFFSITE and ONSITE AC power systems such that any additional single failure would result in a station blackout. This condition could occur due to a loss of OFFSITE power with a concurrent failure of all but one emergency generator to supply power to its emergency busses.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of OFFSITE power.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, CU3
2. NEI 99-01 Rev 5, FAQ# 36

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU2

INITIATING CONDITION:

Loss of required DC power for 15 minutes or longer.

Operating Mode Applicability:

5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. Bus voltage indication on the **required** DC busses less than the following for **15 minutes** or longer:

   - **< 110.4 VDC** on Bus 1-1 or Bus 1-2
   - **< 110.0 VDC** on Bus 1-3 or Bus 1-4

Basis:

Generic

The purpose of this IC and its associated EAL is to recognize a loss of DC power compromising the ability to monitor and control the removal of decay heat during cold shutdown or refueling operations. This EAL is intended to be anticipatory in as much as the operating crew may not have necessary indication and control of equipment needed to respond to the loss.]

Plants will routinely perform maintenance on a train related basis during shutdown periods. It is intended that the loss of the operating (operable) train is to be considered.

Site specific bus voltage should be based on the minimum bus voltage necessary for the operation of safety related equipment. This voltage value should incorporate a margin of at least 15 minutes of operation before the onset of inability to operate those loads. This voltage is usually near the minimum voltage selected when battery sizing is performed. Typically the value for the entire battery set is approximately 105 VDC. For a 60 cell string of batteries the cell voltage is typically 1.75 Volts per cell. For a 58 string battery set the minimum voltage is typically 1.81 Volts per cell.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU2 (continued)

Site Specific

The safety-related 125 VDC Power Distribution System is composed of the following [Technical Specification Bases 3.8.5 & UFSAR Section 8.5.3]:

- two 1700 amp-hour [BAT-1-1 & -2] + two 2400 amp-hour [BAT-1-3 & -4] batteries
- four dual unit 100 amp battery chargers
- four 125 VDC DC Switchboards [DC-SWBD1-1, -2, -3 & -4]
- four 125 VDC distribution panels

The system also supports a 120 VAC Vital Bus System (that powers vital plant instrumentation), which is powered from 125 VDC / 120 VAC inverters (or by rectified 480 VAC power being inverted, when AC power is available).

The 125 VDC and 120 VAC Vital Bus Systems are designed to provide redundant and reliable power to components and systems that are essential to plant safety, including the Reactor Protective System (RPS) and the Engineered Safety Feature Actuation System (ESFAS) (Technical Bases 3.8.8).

The station batteries supply essential and nonessential 125 VDC loads and distribution panels during a loss of the battery charger supply. The batteries are sized to supply the station DC and AC vital bus loads for a period of 2 hours without AC power (UFSAR Section 8.5.3).

The 60 cell station batteries [BAT-1-1 & -2] have a minimum design end of battery cycle voltage of 110.4 VDC, which is equivalent to an average of 1.84 volts per cell (1DBD-39 & UFSAR 8.5.3).

The 59 cell station batteries [BAT-1-3 & -4] have a minimum design end of battery cycle voltage of 110.0 VDC, which is equivalent to an average of 1.864 volts per cell (1DBD-39 & UFSAR 8.5.3).

Basis Reference(s):

1. NEI 99-01 Rev 5, CU7
2. U1 UFSAR, Section 8.5.3, 125 V D-C Power System, Rev 26
3. BVPS-1 & 2 Technical Specification Bases 3.8.5, DC Sources – Shutdown, Rev 0
4. BVPS-1 & 2 Technical Specification Bases 3.8.8, Inverters – Shutdown, Rev 0
5. 1DBD-39, Design Basis Document for 125 VDC Power System, Rev 6

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU3

INITIATING CONDITION:

Inadvertent criticality.

Operating Mode Applicability:

5, 6

EALs:

1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.

Basis:

Generic

This IC addresses inadvertent criticality events that occur in cold shutdown or refueling modes such as fuel mis-loading events and inadvertent dilution events. This IC indicates a potential degradation of the level of safety of the plant, warranting an UNUSUAL EVENT EMERGENCY CLASSIFICATION LEVEL.

This condition can be identified using the startup rate monitor. The term "sustained" is used in order to allow exclusion of expected short term positive periods/startup rates from planned fuel bundle or control rod movements during core alteration. These short term positive startup rates are the result of the increase in neutron population due to subcritical multiplication.

Site Specific

This condition can be identified using:

- Source Range Detectors N-31 & N-32
- Intermediate Range Detectors N-35 & N-36
- Scaler Timer N-34 (Audible Count Rate)

Basis Reference(s):

1. NEI 99-01 Rev 5, CU8
2. Regulatory Guide 8.12, Criticality Accident Alarm Systems

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU6

INITIATING CONDITION:

Loss of all ONSITE or OFFSITE communications capabilities.

Operating Mode Applicability:

5, 6, D

EALs:

1. Loss of **ALL** of the following ONSITE communication methods affecting the ability to perform routine operations:
   - Radios.
   - Plant page.
   - Plant telephone System (hardwired).

   OR

2. Loss of **ALL** of the following OFFSITE communications methods affecting the ability to perform OFFSITE notifications:
   - NRC Emergency Notification System – ENS (Red Phone).
   - NRC Health Physics Network – HPN.
   - Commercial telephones (hardwired and wireless).

Basis:

Generic

The purpose of this IC and its associated EALs is to recognize a loss of communications capability that either defeats the plant operations staff ability to perform routine tasks necessary for plant operations or the ability to communicate issues with OFFSITE authorities. The loss of OFFSITE communications ability is expected to be significantly more comprehensive than the condition addressed by 10 CFR 50.72.

The availability of one method of ordinary OFFSITE communications is sufficient to inform Federal, State, and local authorities of plant issues. This EAL is intended to be used only when extraordinary means (e.g., relaying of information from non-routine radio transmissions, individuals being sent to OFFSITE locations, etc.) are being used to make communications possible.

Site specific list for ONSITE communications loss must encompass the loss of all means of communications (e.g., commercial telephones, sound powered phone systems, plant page systems and radios).

Site specific list for OFFSITE communications loss must encompass the loss of all means of communications with OFFSITE authorities. This should include the ENS, commercial telephone lines, telecopy transmissions, and dedicated phone systems.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU6 (continued)

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, CU6

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CG7

INITIATING CONDITION:

Loss of RCS inventory affecting fuel clad integrity with containment challenged.

Operating Mode Applicability:

5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. a. RCS level **< 56%** RVLIS Full Range (top of active fuel) for **30 minutes** or longer.

   AND

   b. **ANY Table C-1** containment challenge indications.

   OR

2. a. RCS level cannot be monitored with core uncovery for **30 minutes** or longer.

   AND

   b. Loss of RCS inventory as indicated by **ANY** of the following:

   - Containment Radiation Monitor (RM-1RM-219A or B) **> 15 R/hr**.
   - Erratic source range monitor indication.
   - UNPLANNED level rise in Containment sumps or incore instrument sump.

   AND

   c. **ANY Table C-1** containment challenge indications.

Table C-1: Containment Challenge Indications
• CONTAINMENT CLOSURE not established.
• Hydrogen concentration > 4% inside containment.
• UNPLANNED rise in containment pressure.

CG7 (continued)

Basis:

Generic

This IC represents the inability to restore and maintain RPV level to above the top of active fuel with containment challenged. Fuel damage is probable if RPV level cannot be restored, as available decay heat will cause boiling, further reducing the RPV level. With the containment breached or challenged then the potential for unmonitored fission product release to the environment is high. This represents a direct path for radioactive inventory to be released to the environment. This is consistent with the definition of a GENERAL EMERGENCY. The GENERAL EMERGENCY is declared on the occurrence of the loss or IMMINENT loss of function of all three barriers.

These EALs are based on concerns raised by Generic Letter 88-17, "Loss of Decay Heat Removal," SECY 91-283, "Evaluation of Shutdown and Low Power Risk Issues," NUREG-1449, "Shutdown and Low-Power Operation at Commercial Nuclear Power Plants in the United States," and NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management."

A number of variables can have a significant impact on heat removal capability challenging the fuel clad barrier. Examples include: mid-loop, reduced level/flange level, head in place, cavity flooded, RCS venting strategy, decay heat removal system design, vortexing pre-disposition, and U-tube draining.

Analysis indicates that core damage may occur within an hour following continued core uncovery therefore, 30 minutes was conservatively chosen.

If CONTAINMENT CLOSURE is re-established prior to exceeding the 30 minute core uncovery time limit, then escalation to GENERAL EMERGENCY would not occur.

Site shutdown contingency plans typically provide for re-establishing CONTAINMENT CLOSURE following a loss of heat removal or RCS inventory functions.

In the early stages of a core uncovery event, it is unlikely that hydrogen buildup due to a core uncovery could result in an explosive mixture of dissolved gases in containment. However, containment monitoring and/or sampling should be performed to verify this assumption and a GENERAL EMERGENCY declared if it is determined that an explosive mixture exists.

EAL #2

Sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CG7 (continued)

In the cold shutdown mode, normal RCS level and RPV level instrumentation systems will usually be available. In the Refueling mode, normal means of RPV level indication may not be available. Redundant means of RPV level indication will usually be installed (including the ability to monitor level visually) to assure that the ability to monitor level will not be interrupted. However, if all level indication were to be lost during a loss of RCS inventory event, the operators would need to determine that RPV inventory loss was occurring by observing sump and tank level changes. Sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage.

As water level in the RPV lowers, the dose rate above the core will increase. The dose rate due to this core shine should result in site specific monitor indication and possible alarm.

This EAL should conservatively estimate a site specific dose rate setpoint indicative of core uncovery (i.e., level at TOAF).

For PWRs, post-TMI studies indicated that the installed nuclear instrumentation will operate erratically when the core is uncovered and that this should be used as a tool for making such determinations.

Site Specific

EAL #2.b bullet #1

Containment radiation levels are indicated on containment radiation monitors (CRMs) RM-1RM-219A and 219B. These monitors are not located within line of sight of the reactor vessel. The containment radiation monitor alert alarm is set at 4.58E+2 R/hr and high alarm is set at 1.4E+4 R/hr. The alarm setpoints are considered operationally significant, but above what would be expected for a loss of vessel level while in the refuel mode. The CG7/CS7 CRM threshold values have been established at 15 R/Hr (~10x the low scale reading of 1.5 R/hr) to provide a reasonable and conservative indication of abnormal conditions associated with elevated radiation levels in containment due to a loss of water level with irradiated fuel in the vessel.

EAL #2.b bullet #2

Erratic Source Range Monitors indication can be identified using:

- Source Range Detectors N-31 & N-32
- Intermediate Range Detectors N-35 & N-36
- Scaler Timer N-34 (Audible Count Rate)

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CG7 (continued)

Table C-1

If hydrogen concentration reaches or exceeds 4% in an oxygen rich environment, a potentially combustible mixture exists.

Hydrogen monitors, although available at all times, are not in service during normal operations. They are started per 1OM-46.4.G.

The hydrogen monitor measurement range is 0 - 10 volume percent.

Basis Reference(s):

1. NEI 99-01 Rev 5, CG1
2. 1OM-6.5.B.7, RVLIS Full Range Level vs. Reactor Vessel Height, Rev 0
3. 1OM-46.4.G, Placing Wide Range Containment Hydrogen Monitoring Sys in Operation, Rev 4

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CS7

INITIATING CONDITION:

Loss of RCS inventory affecting core decay heat removal capability.

Operating Mode Applicability:

5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. a. CONTAINMENT CLOSURE not established.

   AND

   b. RCS level **< 64%** RVLIS Full Range (6" below bottom of hot leg).

OR

2. a. CONTAINMENT CLOSURE established.

   AND

   b. RCS level **< 56%** RVLIS Full Range (top of active fuel).

OR

3. a. RCS level cannot be monitored for **30 minutes** or longer.

   AND

   b. Loss of RCS inventory as indicated by **ANY** of the following:

   - Containment Radiation Monitor (RM-1RM-219A or B) **> 15 R/hr**.
   - Erratic source range monitor indication.
   - UNPLANNED level rise in Containment sumps or incore instrument sump.

Basis:

Generic

Under the conditions specified by this IC, continued decrease in RCS/RPV level is indicative of a loss of inventory control. Inventory loss may be due to an RCS breach, pressure boundary leakage, or continued boiling in the RPV. Thus, declaration of a SITE AREA EMERGENCY is warranted.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CS7 (continued)

EAL #1

6" below the bottom ID of the RCS Loop should be the level equal to 6" below the bottom of the RPV loop penetration (not the low point of the loop). PWRs unable to measure this level should choose the first observable point below the bottom ID of the loop as the EAL value. If a water level instrument is not available such that the PWR EAL value cannot be determined, then EAL 3 should be used to determine if the IC has been met.

EAL #3

In the Cold Shutdown mode, normal RCS level and RPV level instrumentation systems will usually be available. In the Refueling mode, normal means of RPV level indication may not be available. Redundant means of RPV level indication will usually be installed (including the ability to monitor level visually) to assure that the ability to monitor level will not be interrupted. However, if all level indication were to be lost during a loss of RCS inventory event, the operators would need to determine that RPV inventory loss was occurring by observing sump and tank level changes. Sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage.

The 30-minute duration allows sufficient time for actions to be performed to recover inventory control equipment.

As water level in the RPV lowers, the dose rate above the core will increase. The dose rate due to this core shine should result in site specific monitor indication and possible alarm.

This EAL should conservatively estimate a site specific dose rate setpoint indicative of core uncovery (i.e., level at TOAF).

Post-TMI studies indicated that the installed nuclear instrumentation will operate erratically when the core is uncovered and that this should be used as a tool for making such determinations.

Site Specific

EAL #3.b bullet #1

Containment radiation levels are indicated on containment radiation monitors (CRMs) RM-1RM-219A and 219B. These monitors are not located within line of sight of the reactor vessel. The containment radiation monitor alert alarm is set at 4.58E+2 R/hr and high alarm is set at 1.4E+4 R/hr. The alarm setpoints are considered operationally significant, but above what would be expected for a loss of vessel level while in the refuel mode. The CG7/CS7 CRM threshold values have been established at 15 R/Hr (~10x the low scale reading of 1.5 R/hr) to provide a reasonable and conservative indication of abnormal conditions associated with elevated radiation levels in containment due to a loss of water level with irradiated fuel in the vessel.

CS7 (continued)

EAL #3.b bullet #2

Erratic Source Range Monitors indication can be identified using:

- Source Range Detectors N-31 & N-32
- Intermediate Range Detectors N-35 & N-36
- Scaler Timer N-34 (Audible Count Rate)

Basis Reference(s):

1. NEI 99-01 Rev 5, CS1
2. NEI 99-01 Rev 5, FAQ# 10
3. 1OM-6.5.B.7, RVLIS Full Range Level vs. Reactor Vessel Height, Rev 0

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CA7

INITIATING CONDITION:

Loss of RCS inventory.

Operating Mode Applicability:

5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. Loss of RCS inventory as indicated by **ANY** of the following:

   - RVLIS Full Range Level (LT-1RC-1311) **< 65%** (bottom of hot leg).
   - Refueling Outage Temporary Level Instrument (LI-1RC-481C) **< 16** inches (Reduced Inventory Only)
   - Refueling Outage Temporary Level Instrument (LI-1RC-482C) **< 6** inches (Midloop Only)

   OR

2. a. RCS level cannot be monitored for **15 minutes** or longer.

   AND

   b. Loss of RCS inventory as indicated by UNPLANNED level rise in Containment sumps or incore instrument sump.

Basis:

Generic

These EALs serve as precursors to a loss of ability to adequately cool the fuel. The magnitude of this loss of water indicates that makeup systems have not been effective and may not be capable of preventing further RPV level decrease and potential core uncovery. This condition will result in a minimum EMERGENCY CLASSIFICATION LEVEL of an ALERT.

EAL #1

The PWR Bottom ID of the RCS Loop setpoint was chosen because at this level remote RCS level indication may be lost and loss of suction to decay heat removal systems has occurred. The Bottom ID of the RCS Loop Setpoint should be the level equal to the bottom of the RPV loop penetration (not the low point of the loop).

CA7 (continued)

The inability to restore and maintain level after reaching this setpoint would be indicative of a failure of the RCS barrier.

EAL #2

In the Cold Shutdown mode, normal RCS level and RPV level instrumentation systems will usually be available. In the Refueling mode, normal means of RPV level indication may not be available. Redundant means of RPV level indication will usually be installed (including the ability to monitor level visually) to assure that the ability to monitor level will not be interrupted. However, if all level indication were to be lost during a loss of RCS inventory event, the operators would need to determine that RPV inventory loss was occurring by observing sump and tank level changes. Sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage.

The 15-minute duration for the loss of level indication was chosen because it is half of the CS7 duration. Significant fuel damage is not expected to occur until the core has been uncovered for greater than 1 hour per the analysis referenced in the CG7 basis. Therefore this EAL meets the definition for an ALERT.

Site Specific

EAL #1

RVLIS readings may be affected by RCS Loop Stop valve closure.

Reduced RCS Inventory is an RCS inventory that results in a reactor vessel water level lower than three feet below the reactor vessel flange.

Midloop is the condition that exists whenever the RCS water level is lower than the top of the flow area at the junction of the hot legs with the reactor vessel.

Refueling Outage Temporary Level Instrument LI-1RC-481C (typically available in Mode 6) cannot measure RCS level below 732 feet 3 15/16 inch elevation (reactor pressure vessel nozzle centerline elevations) which corresponds to the lowest increment of 14 inches on the instrument. The EAL value has been established at 16 inches as the lowest distinguishable reading for the instrument. (Reduced Inventory Only)

Refueling Outage Temporary Level Instrument LI-1RC-482C can measure RCS level to "0" inches of the Hot Leg. A value of 6 inches was selected for readability of the instrument. (Midloop Only)

CA7 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, CA1
2. NEI 99-01 Rev 5, FAQ# 10
3. 1OM-6.1.E, Specific Instrumentation and Controls, Rev 8
4. 1OM-6.5.B.1, Table 6-1 - Instrument Inputs to ICCM from RVLIS, Issue 2, Rev 11
5. 1OM-6.5.B.7, RVLIS Full Range Level vs. Reactor Vessel Height, Issue 4, Rev 0
6. 1CMP-6RC-REFL LVL-1C-3I, Temporary RCS Level Indication for Refueling – C Loop (see pages 82, 83 & 88 for L-1RC-481C), Issue 4, Rev 25
7. 1OM-6.4.AP, Issue 3, Rev 1, Reduced Inventory/Midloop Operations Checklist

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU7

INITIATING CONDITION:

RCS leakage.

Operating Mode Applicability:

5

EALs:

Note:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.
- Relief valve normal operation should be excluded unless it fails to close and cannot be isolated.

1. RCS leakage results in the inability to maintain or restore RCS level **> Target Level Band** for **15 minutes** or longer.

Basis:

Generic

This IC is considered to be a potential degradation of the level of safety of the plant. The inability to maintain or restore level is indicative of loss of RCS inventory.

Relief valve normal operation should be excluded from this IC. However, a relief valve that operates and fails to close per design should be considered applicable to this IC if the relief valve cannot be isolated.

The difference between CU7 and CU8 deals with the RCS conditions that exist between cold shutdown and refueling modes. In the refueling mode the RCS is not intact and RPV level and inventory are monitored by different means. In cold shutdown the RCS will normally be intact and standard RCS inventory and level monitoring means are available.

Site Specific

Normally, the RCS level band is established by 1OM-52.4.R.2.F. On loss of coolant in Mode 5, AOP 1OM-53C.4.1.10.1 is used.

Isolating letdown is a standard abnormal operating procedure action and may prevent unnecessary classifications when a non-RCS leakage path such as a CVCS leak exists.

Added generic basis Note for relief valve operation.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU7 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, CU1
2. 1OM-52.4.R.2.F, Refueling Station Shutdown - Mode 5 Activities, Rev 12
3. 1OM-53C.4.1.10.1, Loss of Residual Heat Removal Capability, Rev 12

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU8

INITIATING CONDITION:

UNPLANNED loss of RCS inventory.

Operating Mode Applicability:

6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. UNPLANNED RCS level drop as indicated by **EITHER** of the following:

   - Refueling Outage Temporary Level Instrument (L-1RC-481C) **< 97 inches** (vessel flange) for **15 minutes** or longer when the RCS level band is established **above** the vessel flange.

     OR

   - RCS water level drop below the RCS level band for **15 minutes** or longer when the RCS level band is established **below** the vessel flange.

   OR

2. a. RCS level cannot be monitored.

      AND

   b. Loss of RCS inventory as indicated by UNPLANNED level rise in containment sumps or incore instrument sump.

Basis:

Generic

This IC is a precursor of more serious conditions and considered to be a potential degradation of the level of safety of the plant.

Refueling evolutions that decrease RCS water level below the RPV flange are carefully planned and procedurally controlled. An UNPLANNED event that results in water level decreasing below the RPV flange, or below the planned RCS water level for the given evolution (if the planned RCS water level is already below the RPV flange), warrants declaration of an UNUSUAL EVENT due to the reduced RCS inventory that is available to keep the core covered.

The allowance of 15 minutes was chosen because it is reasonable to assume that level can be restored within this time frame using one or more of the redundant means of refill that should be available. If level cannot be restored in this time frame then it may indicate a more serious condition exists.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU8 (continued)

The difference between CU7 and CU8 deals with the RCS conditions that exist between cold shutdown and refueling modes. In cold shutdown the RCS will normally be intact and standard RCS inventory and level monitoring means are available. In the refueling mode the RCS is not intact and RPV level and inventory are monitored by different means.

EAL #1

This EAL involves a decrease in RCS level below the top of the RPV flange that continues for 15 minutes due to an UNPLANNED event. This EAL is not applicable to decreases in flooded reactor cavity level, which is addressed by RU2.1 until such time as the level decreases to the level of the vessel flange.

EAL #2

This EAL addresses conditions in the refueling mode when normal means of core temperature indication and RCS level indication may not be available. Redundant means of RCS level indication will normally be installed (including the ability to monitor level visually) to assure that the ability to monitor level will not be interrupted. However, if all level indication were to be lost during a loss of RCS inventory event, the operators would need to determine that RCS inventory loss was occurring by observing sump and tank level changes. Sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage.

Site Specific

EAL #1

The Reactor Vessel flange is at 739 feet 2 3/8 inches (96.9 inches indicated). RCS level is normally monitored using the following instrument:

- L-1RC-481C

Reactor vessel level indication (L-1RC-481C) provide accurate indication of water level when the RCS is at atmospheric pressure and above the centerline of the hot leg nozzle elevation.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU8 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, CU2
2. NEI 99-01 Rev 5, FAQ# 10
3. 1OM-6.4.N, Draining the RCS for Refueling, Rev 22
4. 1OM-6.5.A.84, Figure 6-84 RCS Level Scale, Issue 4, Rev 1
5. 1CMP-6RC-REFL LVL-1A-3I, Temporary RCS Level Indication for Refueling – A Loop (see pages 77 & 78 for L-1RC-481A), Issue 4, Rev 12
6. 1CMP-6RC-REFL LVL-1C-3I, Temporary RCS Level Indication for Refueling – C Loop (see pages 82, 83 & 88 for L-1RC-481C), Issue 4, Rev 25

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CA10

INITIATING CONDITION:

Inability to maintain plant in cold shutdown.

Operating Mode Applicability:

5, 6

EALs:

Note: Full inventory is pressurizer level ≥ 22% actual with loop stops either isolated or unisolated.

1. RCS temperature **> 200° F** due to an UNPLANNED loss of decay heat removal capability for greater than the specified duration on **Table C-2**.

Table C-2: RCS Reheat Duration Thresholds		
RCS	**CONTAINMENT CLOSURE**	**Duration**
Intact with Full RCS Inventory	N/A	> 60 minutes**
Not Intact OR Not Full RCS Inventory	Established	> 20 minutes**
	Not Established	0 minutes

** If an RCS heat removal system is in operation within this time frame and RCS temperature is being reduced, then this EAL is not applicable.

OR

2. a. RCS temperature cannot be monitored.

   AND

   b. RCS pressure rise **> 10 psi** due to an UNPLANNED loss of decay heat removal capability (this EAL does not apply in RCS solid plant conditions).

Basis:

Generic

For PWRs, this IC and its associated EALs are based on concerns raised by Generic Letter 88-17, "Loss of Decay Heat Removal." A number of phenomena such as pressurization, vortexing, RCS level differences when operating at a mid-loop condition, decay heat removal system design, and level instrumentation problems can lead to conditions where decay heat removal is lost and core uncovery can occur. NRC analyses show that there are sequences that can cause core uncovery in 15 to 20 minutes and severe core damage within an hour after decay heat removal is lost.

A loss of Technical Specification components alone is not intended to constitute an ALERT. The same is true of a momentary UNPLANNED excursion above the Technical Specification cold shutdown temperature limit when the heat removal function is available.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CA10 (continued)

EAL #1

The RCS Reheat Duration Threshold table addresses complete loss of functions required for core cooling for greater than 60 minutes during refueling and cold shutdown modes when RCS integrity is established. RCS should be considered intact when the RCS pressure boundary is established (e.g., no freeze seals, nozzle dams installed or SG manways removed). The status of CONTAINMENT CLOSURE in this condition is immaterial given that the RCS is providing a high pressure barrier to fission product release to the environment. The 60 minute time frame should allow sufficient time to restore cooling without there being a substantial degradation in plant safety.

The RCS Reheat Duration Threshold table also addresses the complete loss of functions required for core cooling for greater than 20 minutes during refueling and cold shutdown modes when CONTAINMENT CLOSURE is established but RCS is not intact. As discussed above, RCS should be assumed to be intact when the RCS pressure boundary is established (e.g., no freeze seals, nozzle dams installed or SG manways removed). The allowed 20 minute time frame was included to allow operator action to restore the heat removal function, if possible. The allowed time frame is consistent with the guidance provided by Generic Letter 88-17, "Loss of Decay Heat Removal," (discussed earlier in this basis) and is believed to be conservative given that a low pressure Containment Barrier to fission product release is established.

Finally, the RCS Reheat Duration Threshold table also addresses the complete loss of functions required for core cooling during refueling and cold shutdown modes when neither CONTAINMENT CLOSURE is established nor RCS is intact. RCS is intact when the RCS pressure boundary is in its normal condition for the cold shutdown mode of operation (e.g., no freeze seals or nozzle dams). No delay time is allowed because the evaporated reactor coolant that may be released into the containment during this heatup condition could also be directly released to the environment.

The note (**) indicates that this EAL is not applicable if actions are successful in restoring an RCS heat removal system to operation and RCS temperature is being reduced within the specified time frame.

EAL #2

The 10 psi pressure increase addresses situations where, due to high decay heat loads, the time provided to restore temperature control, should be less than 60 minutes. The RCS pressure setpoint chosen should be 10 psi or the lowest pressure that the site can read on installed Control Board instrumentation that is equal to or greater than 10 psi.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CA10 (continued)

Site Specific

Time to RCS Boiling for various RCS configurations and fluid levels (as a function of time since reactor shutdown) can be found in the Abnormal Operating Procedures (AOPs) 1OM-53C.4.1.10.1 & 2. With RCS loop isolation valves installed at BVPS-1, the shortest RCS time to boiling during a typical scheduled refueling outage is more than 15 minutes.

EAL #1

The following instrumentation is capable of providing indication of an RCS temperature rise that approaches the Technical Specification Cold Shutdown temperature limit of (200° F):

- CETs (Incore Thermocouples)
- RCS Wide Range Hot Leg Instruments
- RCS Wide Range Cold Leg Instruments
- RHR System Inlet Temperature

EAL #2

The following instrumentation is capable of providing indication of a 10 psi increase in RCS pressure:

- RCS Wide Range Pressure Instruments

Basis Reference(s):

1. NEI 99-01 Rev 5, CA4
2. NEI 99-01 Rev 5, FAQ# 13
3. NOP-OP-1005, Shutdown Defense in Depth, Rev 13
4. 1OM-53C.4.1.10.1, Loss of Residual Heat Removal Capability, Rev 12
5. 1OM-53C.4.1.10.2, Loss of RHR While Operating At Reduced Inventory / Midloop Conditions, Rev 8

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU10

INITIATING CONDITION:

UNPLANNED Loss of decay heat removal capability.

Operating Mode Applicability:

5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. RCS temperature **> 200° F** due to an UNPLANNED loss of decay heat removal capability.

   OR

2. Loss of **ALL** RCS temperature and RCS level indication for **15 minutes** or longer.

Basis:

Generic

This IC is a precursor of more serious conditions and, as a result, is considered to be a potential degradation of the level of safety of the plant. In cold shutdown the ability to remove decay heat relies primarily on forced cooling flow. Operation of the systems that provide this forced cooling may be jeopardized due to the unlikely loss of electrical power or RCS inventory. Since the RCS usually remains intact in the cold shutdown mode a large inventory of water is available to keep the core covered.

Entry into cold shutdown conditions may be attained within hours of operating at power. Entry into the refueling mode procedurally may not occur for typically 100 hours (site specific) or longer after the reactor has been shutdown. Thus the heatup threat and therefore the threat to damaging the fuel clad may be lower for events that occur in the Refueling mode with irradiated fuel in the RPV (note that the heatup threat could be lower for cold shutdown conditions if the entry into cold shutdown was following a refueling). In addition, the operators should be able to monitor RCS temperature and RPV level so that escalation to the ALERT level will occur if required.

During refueling the level in the RPV will normally be maintained above the RPV flange. refueling evolutions that decrease water level below the RPV flange are carefully planned and procedurally controlled. Loss of forced decay heat removal at reduced inventory may result in more rapid increases in RCS temperatures depending on the time since shutdown.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU10 (continued)

Unlike the cold shutdown mode, normal means of core temperature indication and RCS level indication may not be available in the refueling mode. Redundant means of RPV level indication are therefore procedurally installed to assure that the ability to monitor level will not be interrupted. However, if all level and temperature indication were to be lost in either the cold shutdown of refueling modes, EAL #2 would result in declaration of an UNUSUAL EVENT if both temperature and level indication cannot be restored within 15 minutes from the loss of both means of indication.

Site Specific

Time to RCS Boiling for various RCS configurations and fluid levels (as a function of time since reactor shutdown) can be found in the Abnormal Operating Procedures (AOPs) 1OM-53C.4.1.10.1 & 2. With RCS loop isolation valves installed at BVPS-1, the shortest RCS time to boiling during a typical scheduled refueling outage is more than 15 minutes.

EAL #1

The following instrumentation is capable of providing indication of an RCS temperature rise that approaches the Technical Specification Cold Shutdown temperature limit of (200° F):

- CET's (incore Thermocouples)
- RCS Wide Range Hot Leg Instruments
- RCS Wide Range Cold Leg Instruments
- RHR System Inlet Temperature

Basis Reference(s):

1. NEI 99-01 Rev 5, CU4
2. NEI 99-01 Rev 5, FAQ# 11
3. NOP-OP-1005, Shutdown Defense in Depth, Rev 13
4. 1OM-53C.4.1.10.1, Loss of Residual Heat Removal Capability, Rev 12
5. 1OM-53C.4.1.10.2, Loss of RHR While Operating At Reduced Inventory / Midloop Conditions, Rev 8

BVPS Unit No. 2 (BVPS-2)

EMERGENCY ACTION LEVELS and Basis

EMERGENCY CLASSIFICATION LEVEL (ECL)

One of a minimum set of names or titles established by the NRC for grouping off normal nuclear power plant conditions according to (1) their relative radiological seriousness, and (2) the time-sensitive ONSITE and OFFSITE radiological emergency preparedness actions necessary to respond to such conditions. The existing radiological EMERGENCY CLASSIFICATION LEVELS, in ascending order of seriousness, are called:

- UNUSUAL EVENT
- ALERT
- SITE AREA EMERGENCY
- GENERAL EMERGENCY

The ECLs are escalated from least severe to most severe according to relative threat to the health and safety of the public and emergency workers. An ECL is determined to be met by identifying abnormal conditions and then comparing them to Initiating Conditions (ICs) through EMERGENCY ACTION LEVELS (EALs) and Fission Product Barrier (FPB) threshold values as discussed below. When multiple EALs are met, event declaration is based in the highest ECL reached.

A state or phase called RECOVERY may be entered prior to returning to a normal organization and operation. Recovery provides dedicated resources and organizational structure in support of restoration and communication activities following the termination of the emergency event.

INITIATING CONDITIONS (ICs)

An IC is one of a predetermined subset of nuclear power plant conditions where either the potential exists for a radiological emergency, or such an emergency has occurred.

The ICs provide a general description of emergency conditions that are organized beneath the broader categories of the ECLs. The IC can be a continuous, measurable condition that is outside Technical Specifications, or it can encompass events such as FIRES or system/equipment failures.

Each IC is given a unique identification code. The prefix and the first letter identifies the recognition category, the second letter identifies the ECL, and the number (which can consist of two numerals) identifies the sequence of the IC within the recognition category. The EAL identification codes are developed as follows:

Recognition Categories

- F – Fission Product Barrier Degradation
- R – Abnormal Rad Levels / Radiological Effluent
- H – Hazards and Other Conditions Affecting Plant Safety

- S – System Malfunctions – Hot
- C – System Malfunctions – Cold (Cold Shutdown / Refueling System Malfunction)
- E – INDEPENDENT SPENT FUEL STORAGE INSTALLATION

EMERGENCY CLASSIFICATION LEVELS (lowest to highest)

- U – UNUSUAL EVENT
- A – ALERT
- S – SITE AREA EMERGENCY
- G – GENERAL EMERGENCY

EMERGENCY ACTION LEVELS (EALs) and Fission Product Barriers (FPBs)

An EAL is a pre-determined, site specific, observable threshold for a plant IC that places the plant in a given EMERGENCY CLASSIFICATION LEVEL. An EAL can be: an instrument reading; an equipment status indicator; a measurable parameter (ONSITE or OFFSITE); a discrete, observable event; results of analyses; entry into specific EMERGENCY OPERATING PROCEDURES; or another phenomenon which, if it occurs, indicates entry into a particular EMERGENCY CLASSIFICATION LEVEL.

EALs are individually identified by the IC identification code followed by the EAL number, such as RG1.1 for a major effluent release or HA3.2 for high winds.

Fission Product Barriers (FPBs) are given unique character identification codes and are further subdivided into loss and potential loss categories. Since meeting or exceeding one or more FPBs can result in various ECLs, the first two letters of the FPB are used to identify the particular barrier by abbreviation. The number in the FPB identification code associates it with a particular FPB recognition category. The FPB identification codes are developed as follows:

Barrier Abbreviation

- FC – FUEL CLAD
- RC – REACTOR COOLANT
- CT – CONTAINMENT

FPB Recognition Categories

- 1 – CRITICAL SAFETY FUNCTION STATUS
- 2 – CONTAINMENT RADIATION MONITORING
- 3 – CORE TEMPERATURE
- 4 – RCS LEVEL
- 5 – RCS LEAK RATE
- 6 – SG TUBE LEAKAGE / RUPTURE
- 7 – RCS ACTIVITY

- 8 – CONTAINMENT CONDITIONS
- 9 – CONTAINMENT ISOLATION
- 10 – ED JUDGMENT

FPBs are treated the same as EALs in that they are applicable only as long as the condition(s) that meet or exceed their thresholds exist. This is in contrast to ECLs which once declared, remain in place until termination or recovery.

EALs and FPBs are predicated on UNPLANNED events. A planned evolution involves actions to address limitations imposed by the evolution, performance of surveillance testing, and implementation of controls prior to knowingly exceeding a threshold. Planned evolutions to test, manipulate, repair, perform maintenance or modifications to systems and equipment that will knowingly result in an EAL or FPB being met or exceeded are not subject to event declaration as long as the planned actions or compensatory measures do not meet an ECL with regard to level of safety and the evolution proceeds as planned.

All EALs and FPBs assume VALID indications, reports or conditions.

For EALs that contain time imbedded criterion, the EMERGENCY DIRECTOR should not wait until the applicable time period has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

Operating Mode Applicability

For purposes of event classification, the following operating mode applicability definitions establish the conditions when the EAL or FPB thresholds represent a threat:

Mode[(a)]	Reactivity Condition, Keff	% Rated Thermal Power[(a)]	Average Coolant Temperature
1) Power Operation	≥ 0.99	> 5%	N/A
2) Startup	≥ 0.99	≤ 5%	N/A
3) Hot Standby	< 0.99	N/A	≥ 350° F
4) Hot Shutdown[(b)]	< 0.99	N/A	350° F > T_{avg} > 200° F
5) Cold Shutdown[(b)]	< 0.99	N/A	≤ 200° F
6) Refueling	One or more reactor vessel head closure bolts less than fully tensioned.		
D) Defueled	All reactor fuel removed from reactor pressure vessel (full core off load during refueling or extended outage).		

(a) Excluding decay heat.

(b) All reactor vessel head closure bolts fully tensioned.

The plant operating mode that existed at the time the event occurred, prior to any protective system or operator action initiated in response to the condition, is compared to the IC/EAL mode applicability.

If an event occurs, and a lower or higher plant operating mode is reached before the EMERGENCY CLASSIFICATION LEVEL can be declared, the EMERGENCY CLASSIFICATION LEVEL shall be based on the mode that existed at the time the event occurred.

For events that occur in Cold Shutdown or Refueling, escalation is via EALs that have Cold Shutdown or Refueling for mode applicability, even if Hot Shutdown (or a higher mode) is entered during any subsequent heat-up. In particular, the FPB threshold values are applicable only to events that initiate in Hot Shutdown or higher.

Gaseous Effluent Flowpaths

NEI 99-01 Rev 5 technical bases criterion that states:

> *The site specific monitor list in EAL #1 should include effluent monitors on all potential release pathways.*

½-ODC-2.02, Attachment P, BVPS-1 and BVPS-2 Gaseous Effluent Release Points provides a table for the initial basis in determining the list of effluent pathways that could be a source for radioactive release in an emergency. ½-ODC-2.02, Attachment P gaseous effluent release point descriptions are as follows:

	Unit 1	**Unit 2**
PROCESS VENT*	X	X
Containment/SLCRS Vent	X	X
Ventilation Vent	X	X
Condensate Polishing Building Vent		X
Waste Gas Storage Vault Vent		X
Decontamination Building Vent		X
Turbine Building Vent		X

* The PROCESS VENT is common to both Units 1 and 2 and is located at the top of the BVPS-1 cooling tower.

The BVPS-2 monitored effluent pathways SLCRS Vent and Ventilation Vent are considered the only potential monitored release path for accident conditions based on the following:

- The following safety-related and/or potentially contaminated areas are provided with ventilation systems: Control building, fuel building, auxiliary building, waste handling building, containment structure, main steam valve area, safeguards area, cable vault and rod control area, decontamination building, and condensate polishing building [UFSAR 11.3.2.4].
- All radiation-controlled area ventilation is processed, if necessary, by HEPA and charcoal filters and released in the ventilation vent or the SLCRS vent [UFSAR 11.3.2.4].

- Subsystems exhaust air that may contain contaminated particulates are sent to filters before discharging to the main ventilation stack into the atmosphere [UFSAR 9.4.16.2]. Exhaust air from all three exhaust subsystems is monitored by off-line gas and particulate detectors prior to being released to the environment through the ventilation stack. All three exhaust fans will be interlocked to stop on high radiation signal [UFSAR 9.4.16.3].
- Air from the auxiliary building and radwaste area is exhausted through the safety-related, redundant filters of the SLCRS vent [UFSAR 9.4.3.3].
- The gaseous waste storage tank discharge path is routed via the BVPS-1 gaseous waste decay tanks discharge path. This path is maintained by a flow control valve and is provided with automatic isolation upon receiving a high radiation signal from the PROCESS VENT final release radiation monitor [UFSAR 11.3.2.3].
- Releases from the condensate polishing building vent and the decontamination building vent are monitored and recorded, but are not significant [UFSAR 11.3.3].
- The containment purge system isolation dampers are only open during plant shutdown. Containment can be purged via Ventilation Vent, SLCRS Vent, or PROCESS VENT [ODCM]. Containment purge releases are normally exhausted from the ventilation vent. In the event of high containment concentrations, the containment purge would be routed out the PROCESS VENT. The lower release rate and better dispersion coefficient from the PROCESS VENT would keep site boundary concentrations below maximum permissible levels [UFSAR 11.3.2.4]. Alignment to the low flow gaseous waste for release through the PROCESS VENT requires a discharge permit and use of 2HVR*RQ104A/B in accordance with 2OM-44C.4.A, Containment Purge Supply and Exhaust System Startup, where automatic isolation occurs upon alarm set at a fraction of the ODCM limit.

EAL Technical Basis Manual Content

Refer to Section 1.0 of the Emergency Preparedness Plan for a comprehensive list of definitions, abbreviations and acronyms that are used throughout the Emergency Plan.

<u>EAL Matrix Table</u>

The EAL Technical Basis Manual contains five EAL matrix tables, one for each of the different EAL recognition categories.

The EAL matrix is designed as an evaluation tool that organizes the ECLs from the highest (GENERAL EMERGENCY) on the left to the lowest (UNUSUAL EVENT) on the right. Evaluating the EALs for each ECL from highest to lowest reduces the possibility that an event will be under classified. All recognition categories are to be reviewed for applicability prior to event declaration.

Other user aids such as wallboards may be developed from the matrix table to support evaluation of abnormal conditions in other human factored formats.

EAL Documentation Format

Each EAL within the technical bases manual is documented in the following manner:

- IC Identification Number
- Initiating Condition
- Operating Mode Applicability
- EALs or FPB Threshold Value(s)
- Basis
    - Generic
    - Site Specific
- Basis Reference(s)

Beaver Valley Power Station Unit No. 2(BVPS-2) to NEI 99-01, Revision 5
IC Cross Reference Tables

NEI to BVPS-2

NEI	BVPS-2	NEI	BVPS-2
FU1	FU1	SU1	SU1
FA1	FA1	SU2	SU5
FS1	FS1	SU3	SU4
FG1	FG1	SU4	SU9
		SU5	SU7
FC1	FC1	SU6	SU6
FC2	FC7	SU8	SU3
FC3	FC3	SA2	SA3
FC4	FC4	SA4	SA4
FC6	FC2	SA5	SA1
FC7	N/A	SS1	SS1
FC8	FC10	SS2	SS3
		SS3	SS2
RC1	RC1	SS6	SS4
RC2	RC5	SG1	SG1
RC4	RC6	SG2	SG3
RC6	RC2		
RC7	N/A	CU1	CU7
RC8	RC10	CU2	CU8
		CU3	CU1
CT1	CT1	CU4	CU10
CT2	CT8	CU6	CU6
CT3	CT3	CU7	CU2
CT4	CT6	CU8	CU3
CT5	CT9	CA1	CA7
CT6	CT2	CA3	CA1
CT7	N/A	CA4	CA10
CT8	CT10	CS1	CS7
		CG1	CG7
AU1	RU1		
AU2	RU2	HU1	HU3
AA1	RA1	HU2	HU4
AA2	RA2	HU3	HU5
AA3	RA3	HU4	HU1
AS1	RS1	HU5	HU6
AG1	RG1	HA1	HA3
		HA2	HA4
		HA3	HA5
		HA4	HA1
		HA5	HA2
		HA6	HA6
		HS2	HS2
		HS3	HS6
		HS4	HS1
		HG1	HG1
		HG2	HG6
		E-HU1	E-HU1

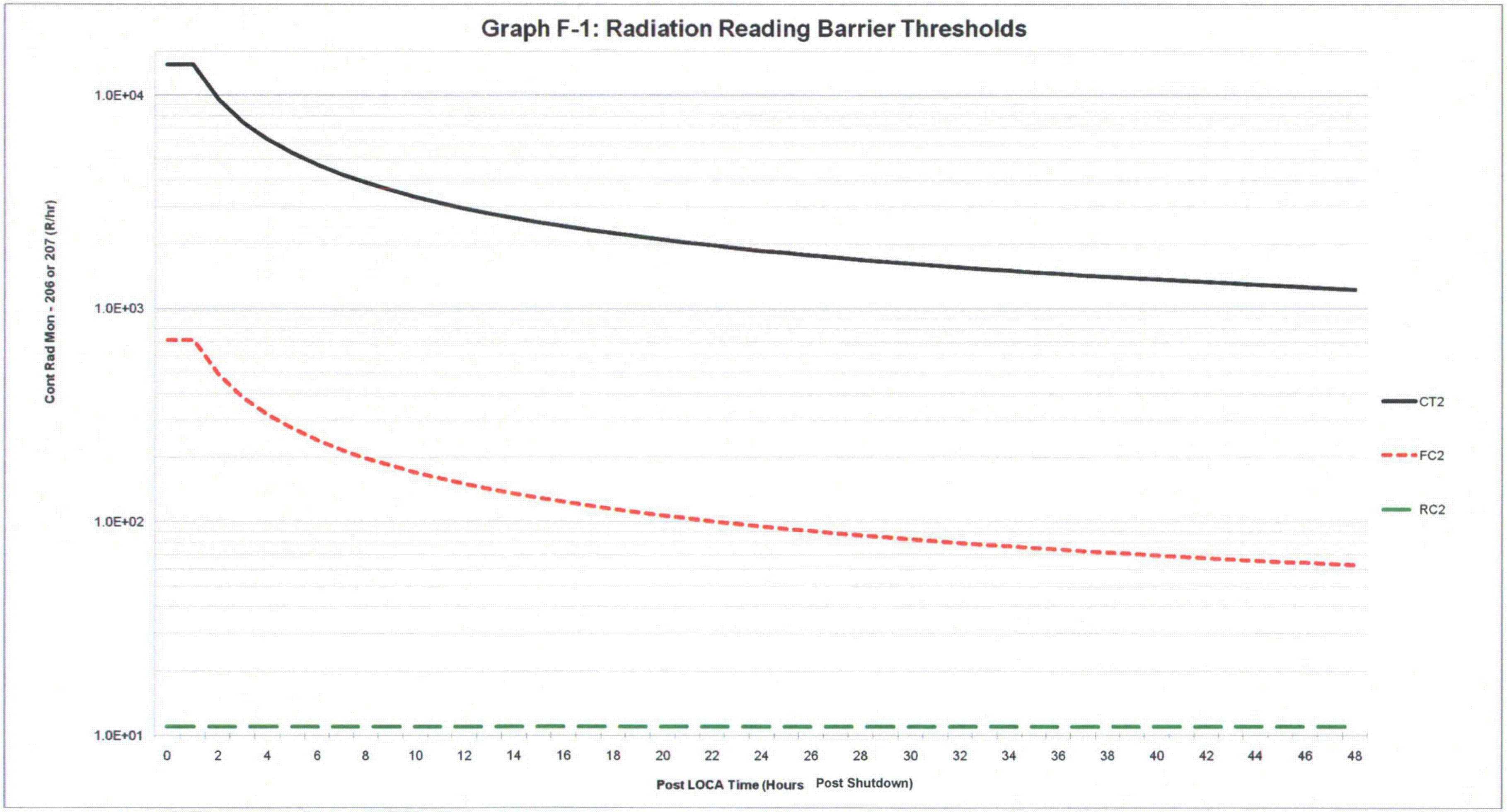
BVPS-2 to NEI

BVPS-2	NEI	BVPS-2	NEI
FG1	FG1	SG1	SG1
FS1	FS1	SS1	SS1
FA1	FA1	SA1	SA5
FU1	FU1	SU1	SU1
		SS2	SS3
FC1	FC1	SG3	SG2
FC2	FC6	SS3	SS2
FC3	FC3	SA3	SA2
FC4	FC4	SU3	SU8
FC7	FC2	SS4	SS6
N/A	FC7	SA4	SA4
FC10	FC8	SU4	SU3
		SU5	SU2
RC1	RC1	SU6	SU6
RC2	RC6	SU7	SU5
RC5	RC2	SU9	SU4
RC6	RC4		
N/A	RC7	CA1	CA3
RC10	RC8	CU1	CU3
		CU2	CU7
CT1	CT1	CU3	CU8
CT2	CT6	CU6	CU6
CT3	CT3	CG7	CG1
CT6	CT4	CS7	CS1
N/A	CT7	CA7	CA1
CT8	CT2	CU7	CU1
CT9	CT5	CU8	CU2
CT10	CT8	CA10	CA4
		CU10	CU4
RG1	AG1		
RS1	AS1	HG1	HG1
RA1	AA1	HS1	HS4
RU1	AU1	HA1	HA4
RA2	AA2	HU1	HU4
RU2	AU2	HS2	HS2
RA3	AA3	HA2	HA5
		HA3	HA1
		HU3	HU1
		HA4	HA2
		HU4	HU2
		HA5	HA3
		HU5	HU3
		HG6	HG2
		HS6	HS3
		HA6	HA6
		HU6	HU5
		E-HU1	E-HU1

FISSION PRODUCT BARRIER DEGRADATION

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
FG1 1 2 3 4 1. Loss of any two barriers and loss or potential loss of the third barrier.	**FS1** 1 2 3 4 1. Loss or potential loss of any two barriers.	**FA1** 1 2 3 4 1. Any loss or any potential loss of either fuel clad or RCS.	**FU1** 1 2 3 4 1. Any loss or any potential loss of containment.



* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

FISSION PRODUCT BARRIER DEGRADATION

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
FG1 1 2 3 4 1. Loss of any two barriers and loss or potential loss of the third barrier.	**FS1** 1 2 3 4 1. Loss or potential loss of any two barriers.	**FA1** 1 2 3 4 1. Any loss or any potential loss of either fuel clad or RCS.	**FU1** 1 2 3 4 1. Any loss or any potential loss of containment.

	FC – Fuel Clad		RC – Reactor Coolant System		CT - Containment	
Sub-Category	**Loss**	**Potential Loss**	**Loss**	**Potential Loss**	**Loss**	**Potential Loss**
1. Critical Safety Function Status	1. Core Cooling - Red entry conditions met.	1. Core Cooling - Orange entry conditions met. **OR** 2. a. Heat Sink - Red entry conditions met. **AND** b. Heat Sink is required.		1. RCS Integrity - Red entry conditions met. **OR** 2. a. Heat Sink - Red entry conditions met. **AND** b. Heat Sink is required.		1. Containment - Red entry conditions met.
2. Containment Rad Monitoring	1. Containment Radiation Monitor (2RMR-RQ206 or 207) **> FC2 Line on Graph F-1.**		1. Containment Radiation Monitor (2RMR-RQ206 or 207) **> 1.1E+01 R/hr (RC2 Line on Graph F-1).**			1. Containment Radiation Monitor (2RMR-RQ206 or 207) **> CT2 Line on Graph F-1.**
3. Core Temperature	1. Three max core exit thermocouples **> 1200° F**.	1. Three max core exit thermocouples **> 729° F**.				1. a. Three max core exit thermocouples **> 2000° F**. **AND** b. Restoration procedures not effective within **15 minutes**. **OR** 2. a. Three max core exit thermocouples **> 1200° F**. **AND** b. RVLIS Full Range **< 40%** with no RCPs running. **AND** c. Restoration procedures not effective within **15 minutes**.
4. RCS Level		1. RCS level **< Table F-1**.				
5. RCS Leak Rate			1. RCS leak rate greater than available makeup capacity as indicated by RCS subcooling **< 19° normal containment** or **< 46° adverse containment**.	1. UNISOLABLE RCS leak exceeding the capacity of one charging pump (130 gpm) in the normal charging mode.		
6. SG Tube Leakage / Rupture			1. RUPTURED SG results in an SI actuation.		**Note:** A prolonged release is greater than 4 hours. 1. RUPTURED SG is also FAULTED outside of containment. **OR** 2. a. Primary-to-Secondary leak rate **> 10 gpm.** **AND** b. UNISOLABLE prolonged steam release from affected SG to the environment.	

Table F-1: RVLIS Thresholds

RVLIS	RCPs	Indication
Full Range	0	40%
Dynamic Range	1	25%
	2	33%
	3	60%

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

FISSION PRODUCT BARRIER DEGRADATION

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
FG1 1 2 3 4 1. Loss of any two barriers and loss or potential loss of the third barrier.	**FS1** 1 2 3 4 1. Loss or potential loss of any two barriers.	**FA1** 1 2 3 4 1. Any loss or any potential loss of either fuel clad or RCS.	**FU1** 1 2 3 4 1. Any loss or any potential loss of containment.

	FC – Fuel Clad		**RC – Reactor Coolant System**		**CT – Containment**	
Sub-Category	**Loss**	**Potential Loss**	**Loss**	**Potential Loss**	**Loss**	**Potential Loss**
7. RCS Activity	1. Coolant activity **> 300 µCi/gm** dose equivalent I-131.					
8. Containment Pressure					1. A containment pressure rise followed by a rapid UNPLANNED drop in containment pressure. **OR** 2. Containment pressure or sump level response not consistent with LOCA conditions.	1. Containment pressure **> 45 psig** and rising. **OR** 2. Containment hydrogen **> 4%**. **OR** 3. a. Containment pressure **> 11 psig**. **AND** c. Less than one full train of depressurization equipment operating.
9. Containment Isolation Failure					**Note:** Direct pathways include filtered pathway (e.g., SLCRS). 1. a. Failure of **ALL** valves in any one line to close. **AND** b. Direct downstream pathway to the environment exists after containment isolation signal.	
10. EMERGENCY DIRECTOR Judgment	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the fuel clad barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the fuel clad barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the RCS barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the RCS barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the containment barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the containment barrier.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

RADIOLOGICAL EFFLUENT / ABNORMAL RADIATION LEVELS

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT

Radiological Effluent

GENERAL EMERGENCY

RG1 1 2 3 4 5 6 D

OFFSITE dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology.

EALs:

Note: If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results.

1. The following gaseous effluent monitor greater than the reading shown for **15 minutes*** or longer:
   - SLCRS Vent (2HVS-RQ109E)...... **1.95E+07 μCi/sec**

   OR

2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER** of the following:
   - **> 1000 mRem** TEDE.
   - **> 5000 mRem** CDE Child Thyroid.

   OR

3. Field survey results at or beyond the site boundary indicate **EITHER** of the following:
   - Gamma (closed window) dose rate **> 1000 mR/hr** for **60 minutes*** or longer.
   - Air sample analysis **> 5000 mRem** CDE Child Thyroid for one hour of inhalation.

SITE AREA EMERGENCY

RS1 1 2 3 4 5 6 D

OFFSITE dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 100 mRem TEDE or 500 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology.

EALs:

Note: If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results.

1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **15 minutes*** or longer:
   - SLCRS Vent (2HVS-RQ109E)...... **1.95E+06 μCi/sec**
   - Ventilation Vent (2HVS-RQ101B) .... **1.67E-01 μCi/cc**

   OR

2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER** of the following:
   - **> 100 mRem** TEDE.
   - **> 500 mRem** CDE Child Thyroid.

   OR

3. Field survey results at or beyond the site boundary indicate **EITHER** of the following:
   - Gamma (closed window) dose rate **> 100 mR/hr** for **60 minutes*** or longer.
   - Air sample analysis **> 500 mRem** CDE Child Thyroid for one hour of inhalation.

ALERT

RA1 1 2 3 4 5 6 D

Any release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM limit for 15 minutes or longer.

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration will likely exceed the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **15 minutes** or longer:
   - SLCRS Vent (2HVS-RQ109E) ..... **5.88E+05 μCi/sec**
   - Ventilation Vent (2HVS-RQ101B).... **6.02E-02 μCi/cc**

   OR

2. a. Liquid Waste Effluent Monitor (2SGC-RQ100) **> 200 times the High alarm setpoint, not to exceed 4.5E-02 μCi/cc,** established by a current radioactivity discharge permit for **15 minutes** or longer.

   OR

3. Confirmed sample analysis for gaseous or liquid releases **> 200 times the ODCM limit** for **15 minutes** or longer.

UNUSUAL EVENT

RU1 1 2 3 4 5 6 D

Any release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes or longer.

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration will likely exceed the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **60 minutes** or longer:
   - SLCRS Vent (2HVS-RQ109E)...... **5.88E+03 μCi/sec**
   - Ventilation Vent (2HVS-RQ101B).... **6.02E-04 μCi/cc**

   OR

2. Liquid Waste Effluent Monitor (2SGC-RQ100 **> 2 times the High alarm setpoint** established by a current radioactivity discharge permit for **60 minutes** or longer:

   OR

3. Confirmed sample analysis for gaseous or liquid releases **> 2 times the ODCM limit** for **60 minutes** or longer.

Abnormal Radiation Levels

ALERT

RA2 1 2 3 4 5 6 D

Damage to irradiated fuel or loss of water level that has resulted or will result in the uncovering of irradiated fuel outside the reactor vessel.

EALs:

1. A water level drop in the spent fuel pool, transfer tube or reactor cavity that will result in irradiated fuel becoming uncovered.

   OR

2. **> 1000 mR/hr** reading on **ANY** of the following due to damage to irradiated fuel or loss of water level:
   - Manipulator Crane (2RMR-RQ203)
   - Fuel Pit Bridge (2RMF-RQ202)

UNUSUAL EVENT

RU2 1 2 3 4 5 6 D

UNPLANNED rise in plant radiation levels.

EALs:

1. a. UNPLANNED water level drop in the spent fuel pool, transfer canal or reactor cavity as indicated by level **< Tech Spec Minimum (23 feet)**.

   AND

   b. Area radiation monitor rise resulting in a High alarm on **ANY** of the following:
   - Manipulator Crane (2RMR-RQ203)
   - Fuel Pit Bridge (2RMF-RQ202)

   OR

2. UNPLANNED area radiation monitor or radiation survey **> 1000 times NORMAL LEVELS**.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

RADIOLOGICAL EFFLUENT / ABNORMAL RADIATION LEVELS

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Abnormal Radiation Levels			**RA3** 1 2 3 4 5 6 D Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions. EALs: 1. Dose rate **> 15 mR/hr** in **ANY** of the following areas requiring continuous occupancy to maintain plant safety functions: • CONTROL ROOM • Central Alarm Station • Secondary Alarm Station	

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Security	**HG1** 1 2 3 4 5 6 D HOSTILE ACTION resulting in loss of physical control of the facility. EALs: 1. A HOSTILE ACTION has occurred such that plant personnel are unable to operate equipment required to maintain safety functions listed below: • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink) **OR** 2. A HOSTILE ACTION has caused failure of spent fuel cooling systems and IMMINENT fuel damage is likely.	**HS1** 1 2 3 4 5 6 D HOSTILE ACTION within the PROTECTED AREA. EALs: 1. A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the Security Shift Supervisor.	**HA1** 1 2 3 4 5 6 D HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat. EALs: 1. A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the Security Shift Supervisor. **OR** 2. A validated notification from the NRC of a LARGE AIRCRAFT attack threat within **30 minutes** of the site.	**HU1** 1 2 3 4 5 6 D Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant. EALs: 1. A SECURITY CONDITION that does not involve a HOSTILE ACTION as reported by the Security Shift Supervisor. **OR** 2. A credible site specific security threat notification. **OR** 3. A validated notification from the NRC providing information of a LARGE AIRCRAFT threat.
CR Evacuation		**HS2** 1 2 3 4 5 6 D CONTROL ROOM evacuation has been initiated and plant control cannot be established. EALs: 1. a. CONTROL ROOM evacuation has been initiated. **AND** b. Control of **ANY** of the following safety functions is not established from an alternate location within **15 minutes**. • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink)	**HA2** 1 2 3 4 5 6 D CONTROL ROOM evacuation has been initiated. EALs: 1. CONTROL ROOM evacuation has been initiated.	

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Natural or Destructive Phenomena	**Table H-1** • Cable Vault and Rod Control Bldg • Containment Building • Control Building • Demin. Water Storage (2FWE-TK210) • Diesel Generator Building • Fuel Handling Building • Intake Structure Pump Cubicles • Main Steam Valve Room • Primary Aux. Building (except elev. 773') • RWST (2QSS-TK21) • Safeguards Building • Service Building (except FW Reg Vlv Rm)		**HA3** 1 2 3 4 5 6 D Natural or destructive phenomena affecting VITAL AREAS. **EALs:** 1. a. Seismic event **> 0.06g** (**OBE**) acceleration (as indicated by lit lamp on 2ERS-CCC-1, Seismic Instrumentation Central Control Cabinet). **AND** b. Earthquake confirmed by **ANY** of the following: • Earthquake felt in plant. • National Earthquake Center. • CONTROL ROOM indication of degraded performance of systems required for the safe shutdown of the plant. **OR** 2. Tornado or high winds **> 80 mph** resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems. **OR** 3. Internal flooding in **Table H-1** areas resulting in **EITHER** of the following: • Electrical shock hazard that precludes access to operate or monitor safety equipment. • CONTROL ROOM indication of degraded performance of those safety systems. **OR** 4. High river level **> 705 feet MSL** resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems. **OR** 5. Low river level (LR-1CW-101) **< 650 feet MSL** resulting in CONTROL ROOM indication of degraded performance of safety systems located in **Table H-1** areas. **OR** 6. Turbine failure-generated PROJECTILES resulting in **EITHER** of the following: • VISIBLE DAMAGE to or penetration of **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems. **OR** 7. Vehicle crash resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems.	**HU3** 1 2 3 4 5 6 D Natural or destructive phenomena affecting the PROTECTED AREA. **EALs:** 1. a. Seismic event **> 0.01g** acceleration (as indicated by initiation of the **Accelerograph Recording System** on Ann A10-5H, Init of Seismic Exceed Preset and/or Spectral Accelerations). **AND** b. Earthquake confirmed by **EITHER** of the following: • Earthquake felt in plant. • National Earthquake Center. **OR** 2. a. Tornado within the PROTECTED AREA. **OR** b. High winds **> 80 mph.** **OR** 3. Internal flooding in **Table H-1** areas that has the potential to affect safety related equipment required by Technical Specifications for the current operating mode. **OR** 4. High river water level **> 705 feet MSL.** **OR** 5. Low river water level (LR-1CW-101) **< 650 feet MSL.** **OR** 6. Turbine failure resulting in casing penetration or damage to turbine or generator seals.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
FIRE / EXPLOSION	**Table H-1** • Cable Vault and Rod Control Bldg • Containment Building • Control Building • Demin. Water Storage (2FWE-TK210) • Diesel Generator Building • Fuel Handling Building • Intake Structure Pump Cubicles • Main Steam Valve Room • Primary Aux. Building (except elev. 773') • RWST (2QSS-TK21) • Safeguards Building • Service Building (except FW Reg Vlv Rm)		**HA4** 1 2 3 4 5 6 D FIRE or EXPLOSION affecting the operability of plant safety systems required to establish or maintain safe shutdown. **EALs:** 1. FIRE or EXPLOSION resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems.	**HU4** 1 2 3 4 5 6 D FIRE within the PROTECTED AREA not extinguished within 15 minutes of detection or EXPLOSION within the PROTECTED AREA. **EALs:** **Note:** Immediately adjacent to applies to FIRES that directly impact or obstruct the areas of concern. 1. FIRE not extinguished within **15 minutes*** of CONTROL ROOM notification or verification of a CONTROL ROOM FIRE alarm in actual contact with or immediately adjacent to **ANY** of the **Table H-1** areas. **OR** 2. EXPLOSION within the PROTECTED AREA.
Toxic Gas			**HA5** 1 2 3 4 5 6 D Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of operable equipment required to maintain safe operations or safely shutdown the reactor. **EALs:** **Notes:** • If the equipment in the stated area was already inoperable, or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event. • This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area. 1. Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of systems required to maintain safe operations or safely shutdown the reactor.	**HU5** 1 2 3 4 5 6 D Release of toxic, corrosive, asphyxiant or flammable gases deemed detrimental to NORMAL PLANT OPERATIONS. **EALs:** **Note:** This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area. 1. Toxic, corrosive, asphyxiant or flammable gases in amounts that have or could adversely affect NORMAL PLANT OPERATIONS. **OR** 2. Report by local, county or state officials for evacuation or sheltering of site personnel based on an OFFSITE event.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the duration has exceeded, or will likely exceed, the applicable time.

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
EMERGENCY DIRECTOR Judgment	**HG6** 1 2 3 4 5 6 D Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of GENERAL EMERGENCY. EALs: 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PROTECTIVE ACTION GUIDE exposure levels OFFSITE for more than the immediate site area.	**HS6** 1 2 3 4 5 6 D Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of SITE AREA EMERGENCY. EALs: 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts: (1) toward site personnel or equipment that could lead to the likely failure of or, (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PROTECTIVE ACTION GUIDE exposure levels beyond *the site boundary.*	**HA6** 1 2 3 4 5 6 D Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an ALERT. EALs: 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA PROTECTIVE ACTION GUIDE exposure levels.	**HU6** 1 2 3 4 5 6 D Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an UNUSUAL EVENT. EALs: 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring OFFSITE response or monitoring are expected unless further degradation of safety systems occurs.
DFSF				**E-HU1** Not Applicable Damage to a loaded cask CONFINEMENT BOUNDARY. EALs: 1. Damage to a loaded cask CONFINEMENT BOUNDARY.

• The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

SYSTEM MALFUNCTIONS - HOT

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Loss of AC Power	**SG1** 1 2 3 4 Prolonged loss of all OFFSITE and all ONSITE AC power to emergency busses. EALs: 1. a. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses. **AND** b. **EITHER** of the following: • Restoration of **EITHER** the AE 4KV emergency bus **OR** DF 4KV emergency bus within **4 hours** is not likely. • Core Cooling - Red entry conditions met.	**SS1** 1 2 3 4 Loss of all OFFSITE and all ONSITE AC power to emergency busses for 15 minutes or longer. EALs: **Note:** Credit cannot be taken for emergency busses being powered from the other unit's emergency diesel generators. 1. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes*** or longer.	**SA1** 1 2 3 4 AC power capability to emergency busses reduced to a single source for 15 minutes or longer. EALs: 1. a. AC power to AE and DF 4KV emergency busses is reduced to a single power source for **15 minutes*** or longer. **AND** b. Any additional single power source failure will result in loss of **ALL** AC power to **BOTH** AE and DF 4KV emergency busses.	**SU1** 1 2 3 4 Loss of all OFFSITE AC power to emergency busses for 15 minutes or longer. EALs: 1. Loss of **ALL** OFFSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes*** or longer.
Loss of DC Power		**SS2** 1 2 3 4 Loss of all vital DC power for 15 minutes or longer. EALs: 1. **< 110.4 VDC** on **ALL** safety related DC busses (2-1, 2-2, 2-3 and 2-4) for **15 minutes*** or longer.		
Failure of RPS	**SG3** 1 2 Automatic trip and all manual actions failed to shutdown the reactor and indication of an extreme challenge to the ability to cool the core exists. EALs: 1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power **> 5%**. **AND** b. **ALL** manual trip actions failed to shutdown the reactor as indicated by reactor power **> 5%**. **AND** c. **EITHER** of the following has occurred: • Core Cooling - Red entry conditions met. • Heat Sink - Red entry conditions met.	**SS3** 1 2 Automatic trip and manual actions taken within the Controls Area (CA) failed to shutdown the reactor. EALs: 1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power **> 5%**. **AND** b. Manual trip actions taken within the Controls Area (CA) failed to shutdown the reactor as indicated by reactor power **> 5%**.	**SA3** 1 2 Automatic trip failed to shutdown the reactor and the manual actions taken from the Controls Area (CA) are successful in shutting down the reactor. EALs: 1. a. An automatic reactor trip failed to shutdown the reactor. **AND** b. Manual trip actions taken within the Controls Area (CA) successfully shutdown the reactor as indicated by reactor power **≤ 5%**.	**SU3** 3 4 Inadvertent criticality. EALs: 1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the duration has exceeded, or will likely exceed, the applicable time.

SYSTEM MALFUNCTIONS - HOT

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Annunciators	**Table S-1: Critical Safety Functions** • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink) **Table S-2: Significant Transients** • Automatic turbine runback > 25% thermal power • Electrical load rejection > 25% full electrical load • Reactor trip • Safety Injection actuation	**SS4** 1 2 3 4 Inability to monitor a significant transient in progress. EALs: 1. a. Loss of **> 75%** of **EITHER** of the following for **15 minutes*** or longer: • CONTROL ROOM Annunciator Panels (A1, A2, A4 - A11). **OR** • CONTROL ROOM critical safety function indications (Table S-1). **AND** b. A **Table S-2** significant transient is in progress. **AND** c. COMPENSATORY INDICATIONS are unavailable.	**SA4** 1 2 3 4 Loss of safety system annunciation or indication in the CONTROL ROOM with either: (1) a significant transient in progress, or (2) COMPENSATORY INDICATIONS are unavailable. EALs: 1. a. Loss of **> 75%** of **EITHER** of the following for **15 minutes*** or longer: • CONTROL ROOM Annunciator Panels (A1, A2, A4 - A11). **OR** • CONTROL ROOM critical safety function indications (Table S-1). **AND** b. **EITHER** of the following: • A **Table S-2** significant transient is in progress. **OR** • COMPENSATORY INDICATIONS are unavailable.	**SU4** 1 2 3 4 Loss of safety system annunciation or indication in the CONTROL ROOM for 15 minutes or longer. EALs: 1. Loss of **> 75%** of **EITHER** of the following for **15 minutes*** or longer: • CONTROL ROOM Annunciator Panels (A1, A2, A4 - A11). **OR** • CONTROL ROOM critical safety function indications (Table S-1).
T.S. Limits				**SU5** 1 2 3 4 Inability to reach required operating mode within Technical Specification limits. EALs: 1. Plant is not brought to required operating mode within Technical Specification LCO action statement time.
Communications				**SU6** 1 2 3 4 Loss of all ONSITE or OFFSITE communications capabilities. EALs: 1. Loss of **ALL** of the following ONSITE communication methods affecting the ability to perform routine operations: • Radios. • Plant page. • Plant telephone system (hardwired). **OR** 2. Loss of **ALL** of the following OFFSITE communications methods affecting the ability to perform OFFSITE notifications: • NRC Emergency Notification System – ENS (Red Phone). • NRC Health Physics Network – HPN. • Commercial telephones (hardwired and wireless).

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the duration has exceeded, or will likely exceed, the applicable time.

SYSTEM MALFUNCTIONS - HOT

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
RCS Leakage				**SU7** 1 2 3 4 RCS leakage. EALs: **Note:** • Identified, unidentified and pressure boundary RCS leakage as defined by Technical Specifications. • Relief valve normal operation should be excluded unless it fails to close and cannot be isolated. 1. Unidentified or pressure boundary leakage **> 10 gpm**. **OR** 2. Identified leakage **> 25 gpm**.
Fuel Clad Degradation				**SU9** 1 2 3 4 Fuel clad degradation. EALs: 1. Letdown Monitor (2CHS-RQ101B) **> 2.98E+03 µCi/cc**. **OR** 2. RCS activity **> 21 µCi/gm** dose equivalent I-131.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

SYSTEM MALFUNCTIONS - COLD

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Loss of AC Power			**CA1** 5 6 D Loss of all OFFSITE and all ONSITE AC power to emergency busses for 15 minutes or longer. **EALs:** 1. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes*** or longer.	**CU1** 5 6 AC power capability to emergency busses reduced to a single source for 15 minutes or longer. **EALs:** 1. a. AC power to AE and DF 4KV emergency busses is reduced to a single source for **15 minutes*** or longer. **AND** b. Any additional single power source failure will result in loss of **ALL** AC power to **BOTH** AE and DF 4KV emergency busses.
Loss of DC Power				**CU2** 5 6 Loss of required DC power for 15 minutes or longer. **EALs:** 1. **< 110.4 VDC** on the required DC busses for **15 minutes*** or longer.
Failure of RPS				**CU3** 5 6 Inadvertent criticality. **EALs:** 1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.
Communications				**CU6** 5 6 D Loss of all ONSITE or OFFSITE communications capabilities. **EALs:** 1. Loss of **ALL** of the following ONSITE communication methods affecting the ability to perform routine operations: • Radios. • Plant page. • Plant telephone system (hardwired). **OR** 2. Loss of **ALL** of the following OFFSITE communications methods affecting the ability to perform OFFSITE notifications: • NRC Emergency Notification System – ENS (Red Phone). • NRC Health Physics Network – HPN. • Commercial telephones (hardwired and wireless).

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

SYSTEM MALFUNCTIONS - COLD

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
RCS Leakage	**CG7** 5 6 Loss of RCS inventory affecting fuel clad integrity with containment challenged. EALs: 1. a. RCS level **< 56%** RVLIS Full Range (top of active fuel) for **30 minutes*** or longer. **AND** b. **ANY Table C-1** containment challenge indications. **OR** 2. a. RCS level cannot be monitored with core uncovery for **30 minutes*** or longer. **AND** b. Loss of RCS inventory as indicated by **ANY** of the following: • Containment Radiation Monitor (2RMR-RQ206 or 207) **> 15 R/hr**. • Erratic source range monitor indication. • UNPLANNED level rise in Containment sumps or incore instrument sump. **AND** c. **ANY Table C-1** containment challenge indications. **Table C-1: Containment Challenge Indications** • CONTAINMENT CLOSURE not established. • Hydrogen concentration > 4% inside containment. • UNPLANNED rise in containment pressure.	**CS7** 5 6 Loss of RCS inventory affecting core decay heat removal capability. EALs: 1. a. CONTAINMENT CLOSURE not established. **AND** b. RCS level **< 64%** RVLIS Full Range (6" below bottom of hot leg). **OR** 2. a. CONTAINMENT CLOSURE established. **AND** b. RCS level **< 56%** RVLIS Full Range (top of active fuel). **OR** 3. a. RCS level cannot be monitored for **30 minutes*** or longer. **AND** b. Loss of RCS inventory as indicated by **ANY** of the following: • Containment Radiation Monitor (2RMR-RQ206 or 207) **> 15 R/hr**. • Erratic source range monitor indication. • UNPLANNED level rise in Containment sumps or incore instrument sump.	**CA7** 5 6 Loss of RCS inventory. EALs: 1. Loss of RCS inventory as indicated by **EITHER** of the following: • RVLIS Full Range Level (2RCS-LT1321) **< 65%** (bottom of hot leg). • Refueling Outage Temporary Level Instrument (2RCS-LI102) **≤ 6 inches**. **OR** 2. a. RCS level cannot be monitored for **15 minutes*** or longer. **AND** b. Loss of RCS inventory as indicated by UNPLANNED level rise in Containment sumps or incore instrument sump.	**CU7** 5 RCS leakage. EALs: **Note:** Relief valve normal operation should be excluded unless it fails to close and cannot be isolated. 1. RCS leakage results in the inability to maintain or restore RCS level **> Target Level Band** for **15 minutes*** or longer. **CU8** 6 UNPLANNED loss of RCS inventory. EALs: 1. UNPLANNED RCS level drop as indicated by **EITHER** of the following: • Refueling Outage Temporary Level Instrument (2RCS-LI102) **< 96 inches** (vessel flange) for **15 minutes*** or longer when the RCS level band is established above the vessel flange. **OR** • RCS water level drop below the RCS level band for **15 minutes*** or longer when the RCS level band is established below the vessel flange. **OR** 2. a. RCS level cannot be monitored. **AND** b. Loss of RCS inventory as indicated by UNPLANNED level rise in containment sumps or incore instrument sump.

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

SYSTEM MALFUNCTIONS - COLD

Modes: 1 – Power Operation, 2 – Startup, 3 – Hot Standby, 4 – Hot Shutdown, 5 – Cold Shutdown, 6 – Refueling, D – Defueled

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
Heat Sink		**Table C-2: RCS Reheat Duration Thresholds** (see table below) ** If an RCS heat removal system is in operation within this time frame and RCS temperature is being reduced, this EAL is not applicable.	**CA10** 5 6 Inability to maintain plant in cold shutdown. **EALs:** **Note:** Full inventory is pressurizer level ≥ 22% actual with loop stops either isolated or unisolated. 1. RCS temperature **> 200° F** due to an UNPLANNED loss of decay heat removal capability for the greater than the specified duration on **Table C-2**. **OR** 2. a. RCS temperature cannot be monitored. **AND** b. RCS pressure rise **> 10 psi** due to an UNPLANNED loss of decay heat removal capability (this EAL does not apply in RCS solid plant conditions).	**CU10** 5 6 UNPLANNED Loss of decay heat removal capability. **EALs:** 1. RCS temperature **> 200° F** due to an UNPLANNED loss of decay heat removal capability. **OR** 2. Loss of **ALL** RCS temperature and RCS level indication for **15 minutes*** or longer.

Table C-2: RCS Reheat Duration Thresholds

RCS	Cont Closure	Duration
Intact with Full RCS Inventory	N/A	> 60 min**
Not Intact	Established	> 20 min**
OR Not Full RCS Inventory	Not Established	0 min

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

FG1

INITIATING CONDITION:

Loss of any two barriers and loss or potential loss of the third barrier.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Refer to fission product barrier loss and potential loss threshold values to determine barrier status.

Basis:

Generic

Fuel cladding, RCS and containment comprise the fission product barriers.

At the GENERAL EMERGENCY CLASSIFICATION LEVEL each barrier is weighted equally.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Tables 5-F-1 and 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

FS1

INITIATING CONDITION:

Loss or potential loss of any two barriers.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Refer to fission product barrier loss and potential loss threshold values to determine barrier status.

Basis:

Generic

Fuel cladding, RCS and containment comprise the fission product barriers.

At the SITE AREA EMERGENCY CLASSIFICATION LEVEL, each barrier is weighted equally.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Tables 5-F-1 and 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

FA1

INITIATING CONDITION:

Any loss or any potential loss of either fuel clad or RCS.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Refer to fission product barrier loss and potential loss threshold values to determine barrier status.

Basis:

Generic

Fuel cladding, RCS and containment comprise the fission product barriers.

The fuel cladding and RCS barriers are weighted more heavily than the containment barrier. Unlike the containment barrier, loss or potential loss of either the fuel cladding or RCS barrier may result in the relocation of radioactive materials or degradation of core cooling capability. Note that the loss or potential loss of containment barrier in combination with loss or potential loss of either fuel cladding or RCS barrier results in declaration of a SITE AREA EMERGENCY under FS1.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Tables 5-F-1 and 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

FU1

INITIATING CONDITION:

Any loss or any potential loss of containment.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Refer to fission product barrier loss and potential loss threshold values to determine barrier status.

Basis:

Generic

Fuel cladding, RCS and containment comprise the fission product barriers.

Unlike the Fuel cladding and RCS barriers, the loss of either of which results in an ALERT under FA1, loss of the containment barrier in and of itself does not result in the relocation of radioactive materials or the potential for degradation of core cooling capability. However, loss or potential loss of the containment barrier in combination with the loss or potential loss of either the fuel cladding or RCS barrier results in declaration of a SITE AREA EMERGENCY under FS1.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Tables 5-F-1 and 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Critical Safety Function Status **FC1**

Loss:

1. Core Cooling - Red entry conditions met.

Potential Loss:

1. Core Cooling - Orange entry conditions met.

   OR

2. a. Heat Sink - Red entry conditions met.

   AND

   b. Heat Sink is required.

Basis:

Generic

Loss Threshold #1

Core Cooling - Red indicates significant superheating and core uncovery and is considered to indicate loss of the Fuel Clad Barrier.

Potential Loss Threshold #1

Core Cooling - Orange indicates subcooling has been lost and that some clad damage may occur.

Potential Loss Threshold #2

Heat Sink - Red when heat sink is required indicates the ultimate heat sink function is under extreme challenge.

Site Specific

Potential Loss Threshold #2

The condition "Heat Sink is required" was added to preclude over-classification for conditions in which RCS pressure is less than steam generator pressure or Heat Sink-Red path entry was created by intentional operator action directed by the EMERGENCY OPERATNG PROCEDURE.

Basis Reference(s):

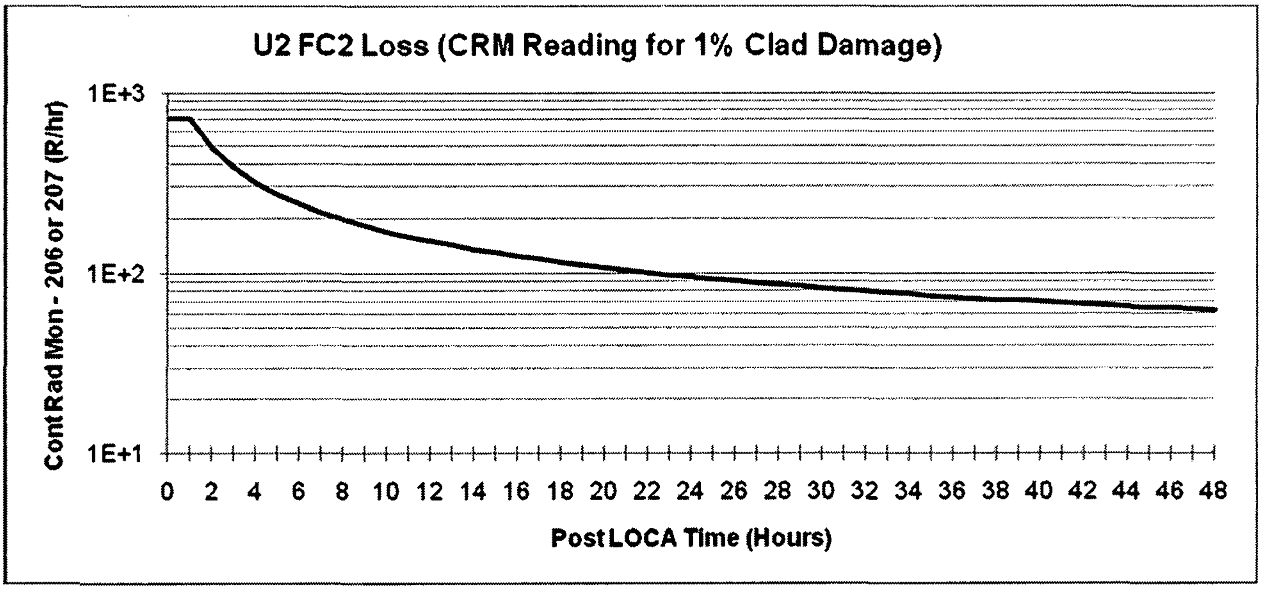
1. NEI 99-01 Rev 5, Table 5-F-3
2. FR-H.1, Loss of Heat Sink

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Containment Radiation Monitoring **FC2**

Loss:

1. Containment Radiation Monitor (2RMR-RQ206 or 207) **> FC2 Line on Graph F-1**.



Potential Loss:

None

Basis:

Generic

The site specific reading is a value which indicates the release of reactor coolant, with elevated activity indicative of fuel damage, into the containment.

The reading should be calculated assuming the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with a concentration of 300 μCi/gm dose equivalent I-131 into the containment atmosphere.

Reactor coolant concentrations of this magnitude are several times larger than the *maximum concentrations (including iodine spiking) allowed within technical* specifications and are therefore indicative of fuel damage.

This value is higher than that specified for RC2(L)1. Thus, this threshold indicates a loss of both the Fuel Clad barrier and RCS barrier that appropriately escalates the EMERGENCY CLASSIFICATION LEVEL to a SITE AREA EMERGENCY.

There is no potential loss threshold associated with this item.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

FC2 (continued)

Site Specific

An RCS activity of 300 μCi/gm dose equivalent I-131 is equivalent to 1% fuel clad gap damage per ERS-SMM-11-002, REV 0.

The containment radiation monitor readings specified in Graph F-1 were derived using 1% clad damage. The CRM values for the 0 to 1 hour period are set at the 1 hour value for ease of use.

FC2: CRM Readings (R/Hr)

Hrs	2RMR-RQ206 or 207
0	7.1E+02
1	7.1E+02
2	4.9E+02
3	3.8E+02
4	3.2E+02
5	2.7E+02
6	2.4E+02
7	2.2E+02
8	2.0E+02
12	1.5E+02
16	1.2E+02
20	1.1E+02
24	9.5E+01
28	8.6E+01
32	8.0E+01
36	7.4E+01
40	7.0E+01
44	6.6E+01
48	6.3E+01

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. ERS-SMM-11-002, Containment Radiation Monitor Readings Following Clad Damage (FC2 Loss, FC7 Loss, RC2 Loss and CT2 Potential Loss), Rev 0

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Core Temperature **FC3**

Loss:

1. Three max core exit thermocouples **> 1200° F**.

Potential Loss:

1. Three max core exit thermocouples **> 729° F**.

Basis:

Generic

Loss Threshold #1

The site specific reading should correspond to significant superheating of the coolant.

This value typically corresponds to the core exit temperature reading that indicates core cooling - Red, which is usually about 1200° F.

Potential Loss Threshold #1

The site specific reading should correspond to loss of subcooling.

This value typically corresponds to the core exit temperature reading that indicates core cooling - Orange, which is usually about 700° to 900° F.

Site Specific

Potential Loss Threshold #1

The value of 729° F was established from 2OM-53A.1.F-0.2 as equivalent to Orange Path in the Core Cooling Critical Safety Function Status Tree per FR-C.1 and FR-C.2.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. 2OM-53A.1.F-0.2 (ISS1C), Core Cooling Status Trees, Rev 1
3. FR-C.1, Inadequate Core Cooling
4. FR-C.2, Degraded Core Cooling

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

RCS Level **FC4**

Loss:

None

Potential Loss:

1. RCS level **< Table F-1**.

Table F-1: RVLIS Thresholds		
RVLIS	**RCPs**	**Indication**
Full Range	0	40%
Dynamic Range	1	25%
	2	33%
	3	60%

Basis:

Generic

There is no loss threshold associated with this item.

The site specific value for the potential loss threshold corresponds to the top of the active fuel.

For sites using CSFSTs, the potential loss threshold is defined by the Core Cooling - Orange path. The site specific value in this threshold should be consistent with the CSFST value.

Site Specific

Beaver Valley used CSFSTs.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. 2OM-53A.1.F-0.2 (ISS1C), Core Cooling Status Trees, Rev 1
3. FR-C.2, Degraded Core Cooling

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

RCS Activity **FC7**

Loss:

1. Coolant activity **> 300 µCi/gm** dose equivalent I-131.

Potential Loss:

None

Basis:

Generic

The site specific value corresponds to 300 µCi/gm I-131 equivalent. Assessment by the EAL Task Force indicates that this amount of coolant activity is well above that expected for iodine spikes and corresponds to less than 5% fuel clad damage. This amount of radioactivity indicates significant clad damage and thus the fuel clad barrier is considered lost.

The results of the sample analysis are expressed as µCi/gm I-131 equivalent.

There is no potential loss threshold associated with this item.

Site Specific

An RCS activity of >300 µCi/gm is above the technical specification limits of 0.35 µCi/gm DEI-131 for steady state and 21 µCi/gm DEI-131 for iodine spiking.

An RCS activity of 300 µCi/gm dose equivalent I-131 is equivalent to 1% fuel clad gap damage per ERS-SMM-11-002, REV 0.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. BVPS-1&2 Technical Specification 3.4.16, RCS Specific Activity
3. ERS-SMM-11-002, Containment Radiation Monitor Readings Following Clad Damage (FC2 Loss, FC7 Loss, RC2 Loss and CT2 Potential Loss), Rev 0

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

EMERGENCY DIRECTOR Judgment **FC10**

Loss:

1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the fuel clad barrier.

Potential Loss:

1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the fuel clad barrier.

Basis:

Generic

These thresholds address any other factors that are to be used by the EMERGENCY DIRECTOR in determining whether the fuel clad barrier is lost or potentially lost. In addition, the inability to monitor the barrier should also be incorporated in this EAL as a factor in EMERGENCY DIRECTOR judgment that the barrier may be considered lost or potentially lost.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Critical Safety Function Status **RC1**

Loss:

None

Potential Loss:

1. RCS Integrity - Red entry conditions met.

   OR

2. a. Heat Sink - Red entry conditions met.

   AND

   b. Heat Sink is required.

Basis:

Generic

There is no loss threshold associated with this item.

Potential Loss Threshold #1

RCS Integrity - Red indicates an extreme challenge to the safety function derived from appropriate instrument readings.

Potential Loss Threshold #2

Heat Sink - Red when heat sink is required indicates the ultimate heat sink function is under extreme challenge.

Site Specific

Potential Loss Threshold #2

The conditional statement was included to allow for the use of available cooling methods within the EOP when determining that the heat sink function was lost or severely degraded when needed. The heat sink function is not considered lost until the EOP methods for temperature control are shown to be unsuccessful.

The condition "Heat Sink is required" was added to preclude over-classification for conditions in which RCS pressure is less than steam generator pressure or Heat Sink-Red path entry was created by intentional operator action directed by the EMERGENCY OPERATING PROCEDURE.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. FR-P.1, Pressurized Thermal Shock
3. FR-H.1, Loss of Heat Sink

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Containment Radiation Monitoring — RC2

Loss:

1. Containment Radiation Monitor (2RMR-RQ206 or 207) **> 1.1E+01 R/hr (RC2 Line on Graph F-1).**

Potential Loss:

None

Basis:

Generic

The site specific reading is a value which indicates the release of reactor coolant to the containment.

The reading should be calculated assuming the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with normal operating concentrations (i.e., within technical specifications) into the containment atmosphere.

This reading will be less than that specified for FC2(L)1. Thus, this threshold would be indicative of a RCS leak only.

There is no potential loss threshold associated with this item.

Site Specific

Technical Specification Basis 3.4.16 analyses are for two cases of RCS activity. The RC2 threshold value is based on the higher RCS TS activity of 21 μCi/gm dose equivalent I-131 to provide an on scale containment radiation monitor reading. A containment monitor reading less that the threshold value would relate to normal RCS (no core damage) activity within technical specifications.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. BVPS-1&2 Technical Specification 3.4.16, RCS Specific Activity
3. ERS-SMM-11-002, Containment Radiation Monitor Readings Following Clad Damage (FC2 Loss, FC7 Loss, RC2 Loss and CT2 Potential Loss), Rev 0

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

RCS Leak Rate **RC5**

Loss:

1. RCS leak rate greater than available makeup capacity as indicated by RCS subcooling **< 19° normal containment** or **< 46° adverse containment.**

Potential Loss:

1. UNISOLABLE RCS leak exceeding the capacity of one charging pump (130 gpm) in the normal charging mode.

Basis:

Generic

Loss Threshold #1

This threshold addresses conditions where leakage from the RCS is greater than available inventory control capacity such that a loss of subcooling has occurred. The loss of subcooling is the fundamental indication that the inventory control systems are inadequate in maintaining RCS pressure and inventory against the mass loss through the leak.

Potential Loss Threshold #1

This threshold is based on the apparent inability to maintain normal liquid inventory within the Reactor Coolant System (RCS) by normal operation of the Chemical and Volume Control System which is considered to be the flow rate equivalent to one charging/makeup pump discharging to the charging header. Isolating letdown is a standard abnormal operating procedure action and may prevent unnecessary classifications when a non-RCS leakage path such as a CVCS leak exists. The intent of this condition is met if attempts to isolate Letdown are NOT successful. Additional charging/makeup pumps being required is indicative of a substantial RCS leak.

Site Specific

Loss Threshold #1

RCS subcooling is determined by evaluation of the saturation temperature that corresponds to the indicated reactor coolant system pressure minus the average reactor coolant loop hot leg temperature or average in-core thermocouple.

Potential Loss Threshold #1

This threshold is based on the capacity of a single charging pump flow of 130 GPM per UFSAR 9.3.4.3.8.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION
RC5 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. U2 UFSAR 9.3.4.3.8, Abnormal Operation, Rev 19
3. 2OM-53A.1.A-5.1, 0F Subcooling Based on Core Exit TCs, Rev 0

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

SG Tube Leakage / Rupture **RC6**

Loss:

1. RUPTURED SG results in an SI actuation.

Potential Loss:

None

Basis:

Generic

This threshold addresses the full spectrum of steam generator (SG) tube rupture events in conjunction with containment barrier loss thresholds. It addresses RUPTURED SG(s) for which the leakage is large enough to cause actuation of ECCS (SI). This is consistent to the RCS leak rate barrier potential loss threshold.

For plants that have implemented Westinghouse Owners Group emergency response guidelines, this condition is described by "entry into E-3 required by EOPs".
By itself, this threshold will result in the declaration of an ALERT. However, if the SG is also FAULTED (i.e., two barriers failed), the declaration escalates to a SITE AREA EMERGENCY per Containment barrier Loss thresholds.

There is no potential loss threshold associated with this item.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

EMERGENCY DIRECTOR Judgment **RC10**

Loss:

1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the RCS barrier.

Potential Loss:

1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the RCS barrier.

Basis:

Generic

These thresholds address any other factors that are to be used by the EMERGENCY DIRECTOR in determining whether the RCS Barrier is lost or potentially lost. In addition, the inability to monitor the barrier should also be incorporated in this EAL as a factor in EMERGENCY DIRECTOR judgment that the barrier may be considered lost or potentially lost.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Critical Safety Function Status **CT1**

Loss:

None

Potential Loss:

1. Containment - Red entry conditions met.

Basis:

Generic

There is no loss threshold associated with this item.

Potential Loss

Red path indicates an extreme challenge to the safety function derived from appropriate instrument readings and/or sampling results, and thus represents a potential loss of containment.

Conditions leading to a containment Red path result from RCS barrier and/or fuel clad barrier loss. Thus, this threshold is primarily a discriminator between SITE AREA EMERGENCY and GENERAL EMERGENCY representing a potential loss of the third barrier.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. FR-Z.1, High Containment Pressure

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

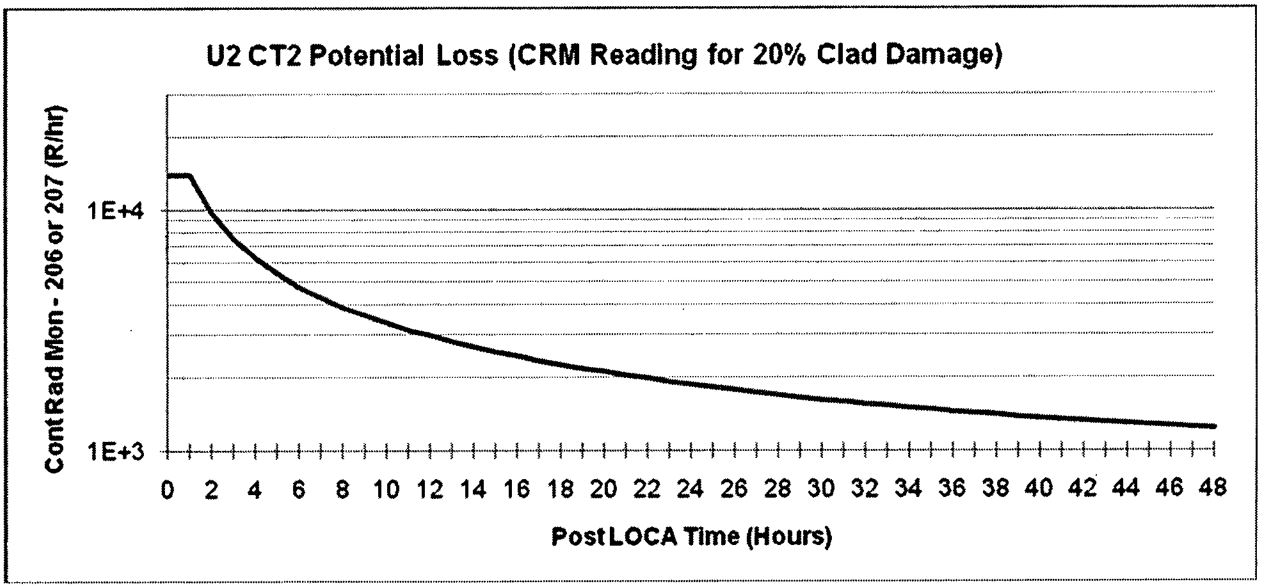
Containment Radiation Monitoring **CT2**

Loss:

None

Potential Loss:

1. Containment Radiation Monitor (2RMR-RQ206 or 207) **> CT2 Line on Graph F-1**.



Basis:

Generic

There is no loss threshold associated with this item.

The site specific reading is a value which indicates significant fuel damage well in excess of the thresholds associated with both loss of fuel clad and loss of RCS barriers. As stated in Section 3.8 of NEI 99-01 Rev 5, a major release of radioactivity requiring OFFSITE PROTECTIVE ACTIONS from core damage is not possible unless a major failure of fuel cladding allows radioactive material to be released from the core into the reactor coolant.

Regardless of whether containment is challenged, this amount of activity in containment, if released, could have such severe consequences that it is prudent to treat this as a potential loss of containment, such that a GENERAL EMERGENCY declaration is warranted.

NUREG-1228, "Source Term Estimation During Incident Response to Severe Nuclear Power Plant Accidents," indicates that such conditions do not exist when the amount of clad damage is less than 20%.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

CT2 (continued)

Site Specific

The containment radiation monitor readings specified in Graph F-1 were derived using 20% clad damage. The CRM values for the 0 to 1 hour period are set at the 1 hour value for ease of use.

CT2: CRM Readings (R/Hr)

Hrs	2RMR-RQ206 or 207
0	1.4E+04
1	1.4E+04
2	9.6E+03
3	7.5E+03
4	6.2E+03
5	5.4E+03
6	4.7E+03
7	4.3E+03
8	3.9E+03
12	3.0E+03
16	2.4E+03
20	2.1E+03
24	1.9E+03
28	1.7E+03
32	1.6E+03
36	1.5E+03
40	1.4E+03
44	1.3E+03
48	1.2E+03

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. ERS-SMM-11-002, Containment Radiation Monitor Readings Following Clad Damage (FC2 Loss, FC7 Loss, RC2 Loss and CT2 Potential Loss), Rev 0
3. 2OM-53E.1.CA-3, Rev 3
4. 2OM-1.2.B, Rev 21
5. U2 UFSAR, Section 6.2.1.1.1, [Containment Functional Design] Design Bases, and Table 6.2.3, Containment Design Evaluation Parameters

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Core Temperature **CT3**

Loss:

None

Potential Loss:

1. a. Three max core exit thermocouples **> 2000° F**.

   AND

   b. Restoration procedures not effective within **15 minutes**.

   OR

2. a. Three max core exit thermocouples **> 1200° F**.

   AND

   b. RVLIS Full Range **< 40%** with no RCPs running.

   AND

   c. Restoration procedures not effective within **15 minutes**.

Basis:

Generic

There is no loss threshold associated with this item.

The conditions in these thresholds represent an IMMINENT core melt sequence which, if not corrected, could lead to vessel failure and an increased potential for containment failure. In conjunction with the Core Cooling and RCS Leakage criteria in the Fuel and RCS barrier columns, this threshold would result in the declaration of a GENERAL EMERGENCY - loss of two barriers and the potential loss of a third. If the function restoration procedures are ineffective, there is no "success" path.

The function restoration procedures are those EMERGENCY OPERATING PROCEDURES that address the recovery of the core cooling critical safety functions. The procedure is considered effective if the temperature is decreasing or if the vessel water level is increasing.

Severe accident analyses (e.g., NUREG-1150) have concluded that function restoration procedures can arrest core degradation within the reactor vessel in a significant fraction of the core damage scenarios, and that the likelihood of containment failure is very small in these events. Given this, it is appropriate to provide a reasonable period to allow function restoration procedures to arrest the core melt sequence.

Whether or not the procedures will be effective should be apparent within 15 minutes. The EMERGENCY DIRECTOR should make the declaration as soon as it is determined that the procedures have been, or will be ineffective.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

CT3 (continued)

Site Specific

Potential Loss Threshold #1

WCAP-14696-A Table 1 provides 2400° F as where a very rapid release of volatile fission products from fuel pellets occurs (departure from failure of fuel rod cladding) and Table 2 establishes core outlet temperatures of > 2000° F as indication of core melt.

The Equipment Qualification Data Package for the Incore Thermocouple provides an extreme qualification of 2200 degrees F, indicating that permanent instrument failure (due to thermocouple materials melting, and potential formation of new junctions) may occur shortly after this EAL threshold value is reached.

Potential Loss Threshold #2

WCAP-14696-A states, "Analyses performed for the WOG ERGs for indication of inadequate core cooling concluded that the temperature indicated by the core exit thermocouples, especially during transient heatup conditions, is always several hundred degrees lower than the fuel rod cladding temperatures. Thus, an indicated temperature of 1200°F can be translated to a peak cladding temperature on the order of 1400°F."

The RCS level is the lowest accurate RVLIS reading and corresponds to a Core Cooling CSF Red PATH terminus. This combined with a RCS superheating as indicated by CET temperature > 1200° F is the site specific indication indicative of RCS level at the top of active fuel.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. WCAP-14696-A, Westinghouse Owners Group Core Damage Assessment Guidance
3. BVPS-2 Vendor Document 2220.100-001-082, Equipment Qualification Data Package, Incore Thermocouple, Rev A

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

SG Tube Leakage / Rupture **CT6**

Loss:

Note: A prolonged release is greater than 4 hours.

1. RUPTURED SG is also FAULTED outside of containment.

   OR

2. a. Primary-to-Secondary leak rate **> 10 gpm**.

   AND

   b. UNISOLABLE *prolonged steam release from affected SG to the* environment.

Potential Loss:

None

Basis:

Generic

The loss threshold recognizes that SG tube leakage can represent a bypass of the Containment Barrier as well as a loss of the RCS Barrier.

Users should realize that the two loss thresholds could be considered redundant. This was recognized during the development process. The inclusion of a threshold that uses emergency procedure commonly used terms like "RUPTURED and FAULTED" adds to the ease of the classification process and has been included based on this human factor concern.

This threshold results in an UNUSUAL EVENT for smaller breaks that: 1) do not exceed the normal charging capacity threshold in RCS leak rate barrier potential loss threshold, or 2) do not result in ECCS actuation in the RCS SG tube rupture barrier loss threshold. For larger breaks, RCS barrier threshold criteria would result in an ALERT. For SG tube ruptures which may involve multiple steam generators or UNISOLABLE secondary line breaks, this threshold would exist in conjunction with RCS barrier thresholds and would result in a SITE AREA EMERGENCY. Escalation to GENERAL EMERGENCY would be based on "Potential Loss" of the Fuel Clad Barrier

Loss Threshold #1

This threshold addresses the condition in which a RUPTURED steam generator is also FAULTED. This condition represents a bypass of the RCS and containment barriers and is a subset of the second threshold. In conjunction with RCS leak rate barrier loss threshold, this would always result in the declaration of a SITE AREA EMERGENCY.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

CT6 (continued)

Loss Threshold #2

This threshold addresses SG tube leaks that exceed 10 gpm in conjunction with an UNISOLABLE release path to the environment from the affected steam generator. The threshold for establishing the UNISOLABLE secondary side release is intended to be a prolonged release of radioactivity from the RUPTURED steam generator directly to the environment. This could be expected to occur when the main condenser is unavailable to accept the contaminated steam (i.e., SG tube rupture with concurrent loss of OFFSITE power and the RUPTURED steam generator is required for plant cooldown or a stuck open relief valve). If the main condenser is available, there may be releases via air ejectors, gland seal exhausters, and other similar controlled, and often monitored, pathways. These pathways do not meet the intent of an UNISOLABLE release path to the environment. These minor releases are assessed using Abnormal Rad Levels / Radiological Effluent ICs.

Site Specific

The threshold for establishing the UNISOLABLE secondary side release is intended to be a prolonged release of radioactivity from the RUPTURED steam generator directly to the environment. This could be expected to occur when the main condenser is unavailable to accept the contaminated steam (i.e., SG tube rupture with concurrent loss of OFFSITE power and the RUPTURED steam generator is required for plant cooldown or a stuck open relief valve). A prolonged release is greater than 4 hours. The 4 hour duration is the minimum time to cool down to Mode 5, at 100 degrees/hr, per Technical Specification cooldown limits.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Containment Pressure **CT8**

Loss:

1. A containment pressure rise followed by a rapid UNPLANNED drop in containment pressure.

   OR

2. Containment pressure or sump level response not consistent with LOCA conditions.

Potential Loss:

1. Containment pressure **> 45 psig** and rising.

   OR

2. Containment hydrogen **> 4%.**

   OR

3. a. Containment pressure **> 11 psig.**

      AND

   b. Less than one full train of depressurization equipment operating.

Basis:

__Generic__

Loss Thresholds #1 and #2

Rapid UNPLANNED loss of pressure (i.e., not attributable to containment spray or condensation effects) following an initial pressure increase from a primary or secondary high energy line break indicates a loss of containment integrity. Containment pressure and sump levels should increase as a result of mass and energy release into containment from a LOCA. Thus, sump level or pressure not increasing indicates containment bypass and a loss of containment integrity.

This indicator relies on operator recognition of an UNPLANNED response for the condition and therefore does not have a specific value associated with it. The UNPLANNED response is important because it is the indicator for a containment bypass condition.

Potential Loss Threshold #1

The site specific pressure is based on the containment design pressure.

Potential Loss Threshold #2

Existence of an explosive mixture means a hydrogen and oxygen concentration of at least the lower deflagration limit curve exists. The indications of potential loss under this EAL corresponds to some of those leading to the Red path in potential loss threshold CT1.1 and may be declared by those sites using CSFSTs.

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

CT8 (continued)

Potential Loss Threshold #3

This threshold represents a potential loss of containment in that the containment heat removal/depressurization system (e.g., containment sprays, ice condenser fans, etc., but not including containment venting strategies) are either lost or performing in a degraded manner, as indicated by containment pressure greater than the setpoint at which the equipment was supposed to have actuated.

Site Specific

Potential Loss Threshold #1

This threshold is the containment design pressure of 45 psig and is above the value projected from the design basis loss of coolant accident. The calculated peak containment internal pressure for the design basis loss of coolant accident is contained in the technical specifications.

Potential Loss Threshold #3

Each unit has a containment pressure quench spray system with two 100% capacity trains. These pumps take suction from the RWST and discharge to the spray header. The quench spray system starts on a CIB at the start of a LOCA accident.

The recirculation spray system has four 50% capacity subsystems that consist of a pump and a cooler. The recirculation spray pump takes suction from the containment sump and discharges through a cooler to the spray header. The recirculation spray system does not start during a LOCA until there is low level in the RWST to verify the sump has adequate water inventory. When the RWST level goes very low the quench spray pumps are secured.

A very short period of time could exist where the quench spray system and the recirculation spray system pumps could both be running. Normally it is either the quench spray or the recirculation spray running.

One train of QS System and one train of RS System comprise one full train of depressurization equipment as designed.

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3
2. NEI 99-01 Rev 5, FAQ# 10
3. U2 UFSAR, 6.2 Containment Systems, 6.2.2.2 System Design, Rev 19
4. FR-Z.1, High Containment Pressure
5. BVPS-1&2 Technical Specification 5.5.12.b, Containment Leakage Rate Testing Program

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

Containment Isolation Failure — CT9

Loss:

Note: Direct pathways include filtered pathways (e.g., SLCRS).

1. a. Failure of **ALL** valves in any one line to close.

   AND

   b. Direct downstream pathway to the environment exists after containment isolation signal.

Potential Loss:

None

Basis:

Generic

This threshold addresses incomplete containment isolation that allows direct release to the environment.

The use of the modifier "direct" in defining the release path discriminates against release paths through interfacing liquid systems. The existence of an in-line charcoal filter does not make a release path indirect since the filter is not effective at removing fission product noble gases. Typical filters have an efficiency of 95-99% removal of iodine. Given the magnitude of the core inventory of iodine, significant releases could still occur. In addition, since the fission product release would be driven by boiling in the reactor vessel, the high humidity in the release stream can be expected to render the filters ineffective in a short period.

There is no Potential Loss threshold associated with this item.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-4

RECOGNITION CATEGORY
FISSION PRODUCT BARRIER DEGRADATION

EMERGENCY DIRECTOR Judgment **CT10**

Loss:

1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the containment barrier.

Potential Loss:

1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the containment barrier.

Basis:

Generic

These thresholds address any other factors that are to be used by the EMERGENCY DIRECTOR in determining whether the Containment Barrier is lost or potentially lost. In addition, the inability to monitor the barrier should also be incorporated in this threshold as a factor in EMERGENCY DIRECTOR judgment that the barrier may be considered lost or potentially lost.

The Containment Barrier should not be declared lost or potentially lost based on exceeding Technical Specification action statement criteria, unless there is an event in progress requiring mitigation by the Containment Barrier. When no event is in progress (loss or potential loss of either fuel clad and/or RCS) the Containment Barrier status is addressed by technical specifications.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, Table 5-F-3

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RG1

INITIATING CONDITION:

OFFSITE dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Notes:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.
- If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results.

1. The following gaseous effluent monitor greater than the reading shown for **15 minutes** or longer:
   - SLCRS Vent (2HVS-RQ109E)..**1.95E+07 µCi/sec**

   OR

2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER** of the following:
   - **> 1000 mRem** TEDE.
   - **> 5000 mRem** CDE Child Thyroid.

   OR

3. Field survey results at or beyond the site boundary indicate **EITHER** of the following:
   - Gamma (closed window) dose rate **> 1000 mR/hr** for **60 minutes** or longer.
   - Air sample analysis **> 5000 mRem** CDE Child Thyroid for one hour of inhalation.

Basis:

Generic

This IC addresses radioactivity releases that result in doses at or beyond the site boundary that exceed the EPA PROTECTIVE ACTION GUIDES (PAGs). Public PROTECTIVE ACTIONS will be necessary. Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public and likely involve fuel damage.

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY
RG1 (continued)

The EPA PAGs are expressed in terms of the sum of the effective dose equivalent (EDE) and the committed effective dose equivalent (CEDE), or as the thyroid committed dose equivalent (CDE). For the purpose of these IC/EALs, the dose quantity total effective dose equivalent (TEDE), as defined in 10 CFR 20, is used in lieu of "...sum of EDE and CEDE...."

The TEDE dose is set at the EPA PAG, while the 5000 mRem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

EAL #1

The site specific monitor list in EAL #1 should include effluent monitors on all potential release pathways.

The monitor reading EALs should be determined using a dose assessment method that back calculates from the dose values specified in the IC. Since doses are generally not monitored in real-time, it is suggested that a release duration of one hour be assumed, and that the EALs be based on a site boundary (or beyond) dose of 1000 mRem whole body or 5000 mRem thyroid in one hour, whichever is more limiting (as was done for EALs #2 and #3). If individual site analyses indicate a longer or shorter duration for the period in which the substantial portion of the activity is released, the longer duration should be used.

The meteorology used should be the same as those used for determining RU1 and RA1 monitor reading EALs. The same source term (noble gases, particulates, and halogens) may also be used as long as it maintains a realistic and near linear escalation between the EALs for the four classifications. If proper escalations do not result from the use of the same source term, if the calculated values are unrealistically high, or if correlation between the values and dose assessment values does not exist, then consider using an accident source term for RS1 and RG1 calculations.

Since dose assessment is based on actual meteorology, whereas the monitor reading EAL is not, the results from these assessments may indicate that the classification is not warranted, or may indicate that a higher classification is warranted. For this reason, EMERGENCY IMPLEMENTING PROCEDURES should call for the timely performance of dose assessments using actual meteorology and release information. If the results of these dose assessments are available when the classification is made (e.g., initiated at a lower classification level), the dose assessment results override the monitor reading EAL.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RG1 (continued)

Site Specific

EAL thresholds reflect state guidance to utilities within their jurisdiction to evaluate the consequences of radiological releases in terms of a CDE Child Thyroid PAG rather than an EPA-400 CDE Thyroid PAG.

EAL #1

The monitor values are based on reaching the limiting PAG at site boundary under the prescribed accident, release, and meteorological conditions. The accident damage nuclide mix is based on a DBA LOCA yield limited to a fuel gap activity release. Complete assumptions and inputs are documented in calculation ERS-MPD-93-008.

Ventilation Vent (2HVS-RQ101B) monitor would be "off-scale" at this release level (maximum indication is 3.72E-01 µCi/cc) if the effluent flowpath was not isolated or aligned to the SLCRS vent. Since this value is only approximately 2x the SITE AREA EMERGENCY level vs. the 10x called for in the technical bases it is not used as a threshold value for the GENERAL EMERGENCY level.

Basis Reference(s):

1. NEI 99-01 REV 5, AG1
2. 1/2-ODC-2.02, ODCM: Gaseous Effluents
3. ERS-MPD-93-008, BVPS – U2 Gaseous Radioactivity Monitor Emergency Action Levels, Rev 7

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RS1

INITIATING CONDITION:

OFFSITE dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 100 mRem TEDE or 500 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Notes:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.
- If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results.

1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **15 minutes** or longer:
   - SLCRS Vent (2HVS-RQ109E)..**1.95E+06 µCi/sec**
   - Ventilation Vent (2HVS-RQ101B).. **1.67E-01 µCi/cc**

   OR

2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER** of the following:
   - **> 100 mRem** TEDE.
   - **> 500 mRem** CDE Child Thyroid.

   OR

3. Field survey results at or beyond the site boundary indicate **EITHER** of the following:
   - Gamma (closed window) dose rate **> 100 mR/hr** for **60 minutes** or longer.
   - Air sample analysis **> 500 mRem** CDE Child Thyroid for one hour of inhalation.

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RS1 (continued)

Basis:

Generic

This IC addresses radioactivity releases that result in doses at or beyond the site boundary that exceed 10% of the EPA PROTECTIVE ACTION GUIDES (PAGs). Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public.

The EPA PAGs are expressed in terms of the sum of the effective dose equivalent (EDE) and the committed effective dose equivalent (CEDE), or as the thyroid committed dose equivalent (CDE). For the purpose of these IC/EALs, the dose quantity total effective dose equivalent (TEDE), as defined in 10 CFR 20, is used in lieu of "...sum of EDE and CEDE...."

The TEDE dose is set at 10% of the EPA PAG, while the 500 mRem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

EAL #1

The site specific monitor list in EAL #1 should include effluent monitors on all potential release pathways.

The monitor reading EALs should be determined using a dose assessment method that back calculates from the dose values specified in the IC. Since doses are generally not monitored in real-time, it is suggested that a release duration of one hour be assumed, and that the EALs be based on a site boundary (or beyond) dose of 100 mRem whole body or 500 mRem thyroid in one hour, whichever is more limiting (as was done for EALs #2 and #3). If individual site analyses indicate a longer or shorter duration for the period in which the substantial portion of the activity is released, the longer duration should be used.

The meteorology used should be the same as those used for determining RU1 and RA1 monitor reading EALs. The same source term (noble gases, particulates, and halogens) may also be used as long as it maintains a realistic and near linear escalation between the EALs for the four classifications. If proper escalations do not result from the use of the same source term, if the calculated values are unrealistically high, or if correlation between the values and dose assessment values does not exist, then consider using an accident source term for RS1 and RG1 calculations.

Since dose assessment is based on actual meteorology, whereas the monitor reading EAL is not, the results from these assessments may indicate that the classification is not warranted, or may indicate that a higher classification is warranted. For this reason, EMERGENCY IMPLEMENTING PROCEDURES should call for the timely performance of dose assessments using actual meteorology and release information. If the results of these dose assessments are available when the classification is made (e.g., initiated at a lower ECL), the dose assessment results override the monitor reading EAL.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RS1 (continued)

Site Specific

EAL thresholds reflect state guidance to utilities within their jurisdiction to evaluate the consequences of radiological releases in terms of a CDE Child Thyroid PAG rather than an EPA-400 CDE Thyroid PAG.

EAL #1

The monitor values are based on reaching 1/10 the limiting PAG at site boundary under the prescribed accident, release, and meteorological conditions. The accident damage nuclide mix is based on a DBA LOCA yield limited to a fuel gap activity release. Complete assumptions and inputs are documented in calculation ERS-MPD-93-008.

Basis Reference(s):

1. NEI 99-01 Rev 5, AS1
2. NEI 99-01 Rev 5, FAQ# 9
3. 1/2-ODC-2.02, ODCM: Gaseous Effluents
4. ERS-MPD-93-008, BVPS – U2 Gaseous Radioactivity Monitor Emergency Action Levels, Rev 7

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RA1

INITIATING CONDITION:

Any release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM limit for 15 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Note:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **15 minutes** or longer:
   - SLCRS Vent (2HVS-RQ109E)..**5.88E+05 µCi/sec**
   - Ventilation Vent (2HVS-RQ101B)... **6.02E-02 µCi/cc**

   OR

   2. Liquid Waste Effluent Monitor (2SGC-RQ100) > **200 times the High alarm setpoint**, not to exceed 4.5E-02 µCi/cc, established by a current radioactivity discharge permit for **15 minutes** or longer.

   OR

3. Confirmed sample analysis for gaseous or liquid releases **> 200 times the ODCM limit** for **15 minutes** or longer.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RA1 (continued)

Basis:

Generic

The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

This IC addresses an actual or substantial potential decrease in the level of safety of the plant as indicated by a radiological release that exceeds regulatory commitments for an extended period of time.

Nuclear power plants incorporate features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, or control and monitor intentional releases. These controls are located in the Offsite Dose Calculation Manual (ODCM). The occurrence of extended, uncontrolled radioactive releases to the environment is indicative of a degradation in these features and/or controls.

The ODCM multiples are specified in RU1 and RA1 only to distinguish between non-emergency conditions, and from each other. While these multiples obviously correspond to an OFFSITE dose or dose rate, the emphasis in classifying these events is the degradation in the level of safety of the plant, not the magnitude of the associated dose or dose rate.

Releases should not be prorated or averaged. For example, a release exceeding 600x ODCM for 5 minutes does not meet the threshold.

This EAL includes any release for which a radioactivity Discharge permit was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit.

EAL #1

This EAL is intended for sites that have established effluent monitoring on non-routine release pathways for which a discharge permit would not normally be prepared.

EAL #2

This EAL addresses radioactivity releases, that for whatever reason, cause effluent radiation monitor readings to exceed the threshold identified in the IC established by the radioactivity discharge permit. This value may be associated with a planned batch release, or a continuous release path.

In either case, the value is established by the ODCM to warn of a release that is not in compliance. Indexing the EAL to the ODCM setpoints in this manner insures that the EAL will never be less than the setpoint established by a specific discharge permit.

EAL #3

This EAL addresses uncontrolled releases that are detected by sample analyses, particularly on unmonitored pathways, e.g., spills of radioactive liquids into storm drains, heat exchanger leakage in river water systems, etc.

Site Specific

An elevated effluent monitor reading where the downstream effluent flow path isolated is not considered a VALID reading.

EAL #1

The gaseous effluent value of 200 times the ODCM setpoint was determined using formulas, isotopic dose conversion factors and meteorology data as specified in the ODCM based on a normal operating isotopic mixture (no clad damage condition). Assumptions and calculation inputs are provided in ERS-HHM-87-014.

EAL #2

The effluent monitors listed are those normally used for planned discharges. If a discharge is performed using a different flowpath or effluent monitor (e.g., a portable or temporary effluent monitor), then the declaration criteria will be based on the monitor specified in the discharge permit.

The threshold of > 200 times the ODCM limit is calculated by the discharge procedure and is within the monitoring range capability of Component Cooling Service Water Liquid (2SWS-RQ101) and Component Cooling Water Heat Exchanger (2SWS-RQ102). Liquid Waste Effluent Monitor (2SGC-RQ100) is limited to a maximum value of 80% top of scale (top of scale is 5.6E-02 µCi/cc, thus 80% is 4.5E-02 µCi/cc) to assure an on scale readable value.

EAL #3

Grab samples are used to determine release concentrations or release rates, confirm meter readings, or indicate the need for sampling when the effluent monitors are not in service or other alarms occur. The maximum instantaneous release rate limits are calculated in accordance with the ODCM. These are indicated on approved discharge permit release packages.

Basis Reference(s):

1. NEI 99-01 Rev 5, AA1
2. 1/2-ODC-2.01, ODCM: Liquid Effluents
3. 1/2-ODC-2.02, ODCM: Gaseous Effluents
4. ERS-HHM-87-014, Unit 1 / Unit 2 ODCM Gaseous Effluent Monitor Setpoints, Rev 4

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RA1 (continued)

5. ERS-MPD-93-008, BVPS – U2 Gaseous Radioactivity Monitor Emergency Action Levels, Rev 7
6. ERS-ATL-93-021, Process Alarm Setpoints for Liquid Effluent Monitors, Rev 3

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RU1

INITIATING CONDITION:

Any release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Note:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **60 minutes** or longer:
   - SLCRS Vent (2HVS-RQ109E) .... **5.88E+03 µCi/sec**
   - Ventilation Vent (2HVS-RQ101B) .... **6.02E-04 µCi/cc**

   OR

2. Liquid Waste Effluent Monitor (2SGC-RQ100 **> 2 times the High alarm setpoint** established by a current radioactivity discharge permit for **60 minutes** or longer:

   OR

3. Confirmed sample analysis for gaseous or liquid releases **> 2 times the ODCM limit** for **60 minutes** or longer.

Basis:

Generic

The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

This IC addresses a potential decrease in the level of safety of the plant as indicated by a radiological release that exceeds regulatory commitments for an extended period of time.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RU1 (continued)

Nuclear power plants incorporate features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, or control and monitor intentional releases. These controls are located in the Offsite Dose Calculation Manual (ODCM). The occurrence of extended, uncontrolled radioactive releases to the environment is indicative of a degradation in these features and/or controls.

The ODCM multiples are specified in RU1 and RA1 only to distinguish between non-emergency conditions, and from each other. While these multiples obviously correspond to an OFFSITE dose or dose rate, the emphasis in classifying these events is the degradation in the level of safety of the plant, not the magnitude of the associated dose or dose rate.

Releases should not be prorated or averaged. For example, a release exceeding 4x ODCM for 30 minutes does not meet the threshold.

This EAL includes any release for which a radioactivity Discharge permit was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit.

EAL #1

This EAL addresses radioactivity releases, that for whatever reason, cause effluent radiation monitor readings to exceed the threshold identified in the IC.

This EAL is intended for sites that have established effluent monitoring on non-routine release pathways for which a Discharge permit would not normally be prepared.

The ODCM establishes a methodology for determining effluent radiation monitor setpoints. The ODCM specifies default source terms and, for gaseous releases, prescribes the use of pre-determined annual average meteorology in the most limiting downwind sector for showing compliance with the regulatory commitments. This EAL is determined using this methodology.

EAL #2

This EAL addresses radioactivity releases, that for whatever reason, cause effluent radiation monitor readings to exceed the threshold identified in the IC established by the radioactivity discharge permit. This value may be associated with a planned batch release, or a continuous release path.

In either case, the value is established by the ODCM to warn of a release that is not in compliance. Indexing the EAL to the ODCM setpoints in this manner insures that the EAL will never be less than the setpoint established by a specific Discharge permit.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RU1 (continued)

EAL #3

This EAL addresses uncontrolled releases that are detected by sample analyses, particularly on unmonitored pathways, e.g., spills of radioactive liquids into storm drains, heat exchanger leakage in river water systems, etc.

Site Specific

An elevated monitor reading while the effluent flow path is isolated is not considered a VALID reading.

EAL #1

The gaseous effluent values of 2 times the ODCM setpoint were determined using formulas, isotopic dose conversion factors and meteorology data as specified in the ODCM based on a normal operating isotopic mixture (no clad damage condition). Assumptions and calculation inputs are provided in ERS-HHM-87-014.

EAL #2

The effluent monitors listed are those normally used for planned discharges. If a discharge is performed using a different flowpath or effluent monitor (e.g., a portable or temporary effluent monitor), then the declaration criteria will be based on the monitor specified in the Discharge permit.

EAL #3

Grab samples are used to: determine release concentrations or release rates, confirm meter readings, or indicate the need for sampling when the effluent monitors are not in service or other alarms occur. The maximum instantaneous release rate limits are calculated in accordance with the ODCM. These are indicated on approved discharge permit release packages.

Basis Reference(s):

1. NEI 99-01 Rev 5, AU1
2. 1/2-ODC-2.01, ODCM: Liquid Effluents
3. 1/2-ODC-2.02, ODCM: Gaseous Effluents
4. ERS-HHM-87-014, Unit 1 / Unit 2 ODCM Gaseous Effluent Monitor Setpoints, Rev 4
5. ERS-MPD-93-008, BVPS – U2 Gaseous Radioactivity Monitor Emergency Action Levels, Rev 7
6. ERS-ATL-93-021, Process Alarm Setpoints for Liquid Effluent Monitors, Rev 3

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RA2

INITIATING CONDITION:

Damage to irradiated fuel or loss of water level that has resulted or will result in the uncovering of irradiated fuel outside the reactor vessel.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. A water level drop in the spent fuel pool, transfer tube or reactor cavity that will result in irradiated fuel becoming uncovered.

   OR

2. **> 1000 mR/hr** on **ANY** of the following due to damage to irradiated fuel or loss of water level:
   - Manipulator Crane (2RMR-RQ203)
   - Fuel Pit Bridge (2RMF-RQ202)

Basis:

Generic

This IC addresses increases in radiation dose rates within plant buildings, and may be a precursor to a radioactivity release to the environment. These events represent a loss of control over radioactive material and represent an actual or substantial potential degradation in the level of safety of the plant.

These events escalate from RU2 in that fuel activity has been released, or is anticipated due to fuel heatup. This IC applies to spent fuel requiring water coverage and is not intended to address spent fuel which is licensed for dry storage.

EAL #1

Site specific indications may include instrumentation such as water level and local area radiation monitors, and personnel (e.g., refueling crew) reports. If available, video cameras may allow remote observation. Depending on available level instrumentation, the declaration threshold may need to be based on indications of water makeup rate or decrease in water storage tank level.

EAL #2

This EAL addresses radiation monitor indications of fuel uncovery and/or fuel damage.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RA2 (continued)

Increased ventilation monitor readings may be indication of a radioactivity release from the fuel, confirming that damage has occurred. Increased background at the ventilation monitor due to water level decrease may mask increased ventilation exhaust airborne activity and needs to be considered.

While a radiation monitor could detect an increase in dose rate due to a drop in the water level, it might not be a reliable indication of whether or not the fuel is covered.

For example, a refueling bridge radiation monitor reading may increase due to planned evolutions such as head lift, or even a fuel assembly being raised in the manipulator mast. Also, a monitor could in fact be properly responding to a known event involving transfer or relocation of a source, stored in or near the fuel pool or responding to a planned evolution such as removal of the reactor head. Generally, increased radiation monitor indications will need to be combined with another indicator (or personnel report) of water loss.

Site Specific

EAL #1

Water level is normally monitored by:

- Spent Fuel Pool Level, 2FNC-LT102A/B.
- PZR Cold Cal Level, 2RCS-LT462.
- Temporary Level Instruments 2RCS-LT102 & 105.

EAL #2

NUREG/CR-4982, "Severe Accident in Spent Fuel Pools in Support of Generic Safety Issue 82," (July, 1987) indicates that even if CORRECTIVE ACTIONS are not taken when spent fuel becomes uncovered, no prompt fatalities are predicted and the risk of injury is low. Therefore, a period of time will be available to take CORRECTIVE ACTIONS prior to the actual onset of fuel damage.

Visual observation of spent fuel uncovery represents a major ALARA concern in that radiation levels could exceed 10,000 R/hr on the refuel bridge when uncovery occurs. The value of 1000 mR/hr was conservatively chosen for classification purposes.

Basis Reference(s):

1. NEI 99-01 Rev 5, AA2
2. Information Notice No. 90-08, KR-85 Hazards from Decayed Fuel

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RU2

INITIATING CONDITION:

UNPLANNED rise in plant radiation levels.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. a. UNPLANNED water level drop in the spent fuel pool, transfer canal or reactor cavity as indicated by level **< Tech Spec Minimum (23 feet)**.

   AND

   b. Area radiation monitor reading rise resulting in a hi alarm on **ANY** of the following:

   - Manipulator Crane (2RMR-RQ203)
   - Fuel Pit Bridge (2RMF-RQ202)

   OR

2. UNPLANNED area radiation monitor or radiation survey **> 1000 times NORMAL LEVELS.**

Basis:

Generic

This IC addresses increased radiation levels as a result of water level decreases above irradiated fuel or events that have resulted, or may result, in UNPLANNED increases in radiation dose rates within plant buildings. These radiation increases represent a loss of control over radioactive material and represent a potential degradation in the level of safety of the plant.

EAL #1

Site specific indications may include instrumentation such as water level and local area radiation monitors, and personnel (e.g., refueling crew) reports. If available, video cameras may allow remote observation. Depending on available level instrumentation, the declaration threshold may need to be based on indications of water makeup rate or decrease in water storage tank level.

While a radiation monitor could detect an increase in dose rate due to a drop in the water level, it might not be a reliable indication of whether or not the fuel is covered.

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RU2 (continued)

For example, a refueling bridge radiation monitor reading may increase due to planned evolutions such as head lift, or even a fuel assembly being raised in the manipulator mast. Also, a monitor could in fact be properly responding to a known event involving transfer or relocation of a source, stored in or near the fuel pool or responding to a planned evolution such as removal of the reactor head. Generally, increased radiation monitor indications will need to be combined with another indicator (or personnel report) of water loss.

For refueling events where the water level drops below the RPV flange classification would be via CU8.

EAL #2

This EAL addresses increases in plant radiation levels that represent a loss of control of radioactive material resulting in a potential degradation in the level of safety of the plant.

This EAL excludes radiation level increases that result from planned activities such as use of radiographic sources and movement of radioactive waste materials. A specific list of ARMs is not required as it would restrict the applicability of the EAL. The intent is to identify loss of control of radioactive material in any monitored area.

Site Specific

EAL Threshold 1.b

Routine rises in radiation monitor readings occur at Beaver Valley due to changes in water level, fuel movement and other routine activities. Radiation monitor setpoints are usually established several millirem above background. The EAL threshold was specified that the rise in the radiation monitor reading would result in an alarm to preclude unwarranted declaration due to expected changes in background levels while still providing indication of loss of water level event.

Basis Reference(s):

1. NEI 99-01 Rev 5, AU2
2. NEI 99-01 Rev 5, FAQ# 5
3. Information Notice No. 90-08, KR-85 Hazards from Decayed Fuel
4. BVPS-1&2 Technical Specification 3.7.15, Fuel Storage Pool Water Level
5. BVPS-1&2 Technical Specification 3.9.6, Refueling Cavity Water Level

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RA3

INITIATING CONDITION:

Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. Dose rate **> 15 mR/hr** in **ANY** of the following areas requiring continuous occupancy to maintain plant safety functions:
   - CONTROL ROOM
   - Central Alarm Station
   - Secondary Alarm Station

Basis:

Generic

This IC addresses increased radiation levels that impede continued operation in areas requiring continuous occupancy to maintain safe operation or to perform a safe shutdown.

The cause and/or magnitude of the increase in radiation levels is not a concern of this IC. The EMERGENCY DIRECTOR must consider the source or cause of the increased radiation levels and determine if any other IC may be involved.

The value of 15 mR/hr is derived from the GDC 19 value of 5 Rem in 30 days with adjustment for expected occupancy times. Although Section III.D.3 of NUREG-0737, "Clarification of TMI Action Plan Requirements," provides that the 15 mR/hr value can be averaged over the 30 days, the value is used here without averaging, as a 30 day duration implies an event potentially more significant than an ALERT.

Areas requiring continuous occupancy include the CONTROL ROOM and, as appropriate to the site, any other control stations that are staffed continuously, such as a radwaste CONTROL ROOM or a security alarm station.

Site Specific

Areas requiring continuous occupancy include the CONTROL ROOM, Central Alarm Station (CAS) and the Secondary Alarm Station (SAS). Although the CAS and SAS are not required for the control of plant safety functions, they are included in this EAL because of Security Plan requirements for continuous occupancy.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

RA3 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, AA3
2. Physical Security Plan/Contingency Plan

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HG1

INITIATING CONDITION:

HOSTILE ACTION resulting in loss of physical control of the facility.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. A HOSTILE ACTION has occurred such that plant personnel are unable to operate equipment required to maintain safety functions listed below:
   - Reactivity Control (ability to shut down the reactor and keep it shut down)
   - RCS inventory (ability to cool the core)
   - Secondary heat removal (ability to maintain a heat sink)

   OR
2. A HOSTILE ACTION has caused failure of spent fuel cooling systems and IMMINENT fuel damage is likely.

Basis:

<u>Generic</u>

<u>EAL #1</u>

This EAL encompasses conditions under which a HOSTILE ACTION has resulted in a loss of physical control of VITAL AREAS (containing VITAL EQUIPMENT or controls of VITAL EQUIPMENT) required to maintain safety functions and control of that equipment cannot be transferred to and operated from another location.

Typically, these safety functions are reactivity control (ability to shut down the reactor and keep it shutdown), RCS inventory (ability to cool the core), and secondary heat removal (ability to maintain a heat sink).

Loss of physical control of the CONTROL ROOM or remote shutdown capability alone may not prevent the ability to maintain safety functions. Design of the remote shutdown capability and the location of the transfer switches should be taken into account. Primary emphasis should be placed on those components and instruments that supply protection for and information about safety functions.

If control of the plant equipment necessary to maintain safety functions can be transferred to another location, then the threshold is not met.

<u>EAL #2</u>

This EAL addresses failure of spent fuel cooling systems as a result of HOSTILE ACTION if IMMINENT fuel damage is likely.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HG1 (continued)

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HG1
2. NEI 99-01 Rev 5, FAQ# 29
3. Physical Security Plan/Contingency Plan

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HS1

INITIATING CONDITION:

HOSTILE ACTION within the PROTECTED AREA.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the Security Shift Supervisor.

Basis:

Generic

This condition represents an escalated threat to plant safety above that contained in the ALERT in that a HOSTILE FORCE has progressed from the OWNER CONTROLLED AREA to the PROTECTED AREA.

This EAL addresses the contingency for a very rapid progression of events, such as that experienced on September 11, 2001. It is not premised solely on the potential for a radiological release. Rather the issue includes the need for rapid assistance due to the possibility for significant and indeterminate damage from additional air, land or water attack elements.

The fact that the site is under serious attack with minimal time available for further preparation or additional assistance to arrive requires Offsite Response Organization (ORO) readiness and preparation for the implementation of protective measures.

This EAL addresses the potential for a very rapid progression of events due to a HOSTILE ACTION. It is not intended to address incidents that are accidental events or acts of civil disobedience, such as small aircraft impact, hunters, or physical disputes between employees within the PROTECTED AREA. Those events are adequately addressed by other EALs.

Although nuclear plant security officers are well trained and prepared to protect against HOSTILE ACTION, it is appropriate for OROs to be notified and encouraged to begin preparations for public PROTECTIVE ACTIONS (if they do not normally) to be better prepared should it be necessary to consider further actions.

If not previously notified by NRC that the airborne HOSTILE ACTION was intentional, then it would be expected, although not certain, that notification by an appropriate Federal agency would follow. In this case, appropriate Federal agency is intended to be NORAD, FBI, FAA or NRC. However, the declaration should not be unduly delayed awaiting Federal notification.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HS1 (continued)

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HS4
2. Physical Security Plan/Contingency Plan

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA1

INITIATING CONDITION:

HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the Security Shift Supervisor.

   OR

2. A validated notification from the NRC of a LARGE AIRCRAFT attack threat within **30 minutes** of the site.

Basis:

Generic

Note: Timely and accurate communication between Security Shift Supervision and the CONTROL ROOM is crucial for the implementation of effective Security EALs.

These EALs address the contingency for a very rapid progression of events, such as that experienced on September 11, 2001. They are not premised solely on the potential for a radiological release. Rather the issue includes the need for rapid assistance due to the possibility for significant and indeterminate damage from additional air, land or water attack elements.

The fact that the site is under serious attack or is an identified attack target with minimal time available for further preparation or additional assistance to arrive requires a heightened state of readiness and implementation of protective measures that can be effective (such as ONSITE evacuation, dispersal or sheltering).

EAL #1

This EAL addresses the potential for a very rapid progression of events due to a HOSTILE ACTION. It is not intended to address incidents that are accidental events or acts of civil disobedience, such as small aircraft impact, hunters, or physical disputes between employees within the OWNER CONTROLLED AREA. Those events are adequately addressed by other EALs.

Note that this EAL is applicable for any HOSTILE ACTION occurring, or that has occurred, in the OWNER CONTROLLED AREA. This includes ISFSI's that may be outside the PROTECTED AREA but still within the OWNER CONTROLLED AREA.

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY
HA1 (continued)

Although nuclear plant security officers are well trained and prepared to protect against HOSTILE ACTION, it is appropriate for the Offsite Response Organization (ORO) to be notified and encouraged to begin activation (if they do not normally) to be better prepared should it be necessary to consider further actions.

If not previously notified by the NRC that the airborne HOSTILE ACTION was intentional, then it would be expected, although not certain, that notification by an appropriate Federal agency would follow. In this case, appropriate Federal agency is intended to be NORAD, FBI, FAA or NRC. However, the declaration should not be unduly delayed awaiting Federal notification.

EAL #2

This EAL addresses the immediacy of an expected threat arrival or impact on the site within a relatively short time.

The intent of this EAL is to ensure that notifications for the LARGE AIRCRAFT attack threat are made in a timely manner and that OROs and plant personnel are at a state of heightened awareness regarding the credible threat.

This EAL is met when a plant receives information regarding an airliner attack threat from NRC and the airliner is within 30 minutes of the plant. Only the plant to which the specific threat is made need declare the ALERT.

The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves a LARGE AIRCRAFT. The status and size of the plane may be provided by NORAD through the NRC.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HA4
2. NEI 99-01 Rev 5, FAQ# 26
3. Physical Security Plan/Contingency Plan

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU1

INITIATING CONDITION:

Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. A SECURITY CONDITION that does not involve a HOSTILE ACTION as reported by the Security Shift Supervisor.

   OR

2. A credible site specific security threat notification.

   OR

3. A validated notification from the NRC providing information of a LARGE AIRCRAFT threat.

Basis:

Generic

Note: Timely and accurate communication between Security Shift Supervision and the CONTROL ROOM is crucial for the implementation of effective Security EALs.

Security events which do not represent a potential degradation in the level of safety of the plant are reported under 10 CFR 73.71 or in some cases under 10 CFR 50.72. Security events assessed as HOSTILE ACTIONs are classifiable under HA1, HS1 and HG1.

A higher initial classification could be made based upon the nature and timing of the Security Threat and potential consequences. The licensee shall consider upgrading the emergency response status and EMERGENCY CLASSIFICATION LEVEL in accordance with the site's Safeguards Contingency Plan and Emergency Plan.

EAL #1

Reference is made to site specific security shift supervision because these individuals are the designated personnel ONSITE qualified and trained to confirm that a security event is occurring or has occurred. Training on security event classification confirmation is closely controlled due to the strict secrecy controls placed on the plant Safeguards Contingency Plan.

This threshold is based on site specific security plans. Site specific Safeguards Contingency Plans are based on guidance provided by NEI 03-12.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU1 (continued)

EAL #2

This threshold is included to ensure that appropriate notifications for the security threat are made in a timely manner. This includes information of a credible threat. Only the plant to which the specific threat is made need declare the UNUSUAL EVENT.

The determination of "credible" is made through use of information found in the site specific Safeguards Contingency Plan.

EAL #3

The intent of this EAL is to ensure that notifications for the aircraft threat are made in a timely manner and that Offsite Response Organizations (OROs) and plant personnel are at a state of heightened awareness regarding the credible threat. It is not the intent of this EAL to replace existing non-hostile related EALs involving aircraft.

This EAL is met when a plant receives information regarding an aircraft threat from NRC. Validation is performed by calling the NRC or by other approved methods of authentication. Only the plant to which the specific threat is made need declare the UNUSUAL EVENT.

The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves a LARGE AIRCRAFT. The status and size of the plane may be provided by NORAD through the NRC.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HU4
2. NEI 99-01 Rev 5, FAQ# 26
3. Physical Security Plan/Contingency Plan

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HS2

INITIATING CONDITION:

CONTROL ROOM evacuation has been initiated and plant control cannot be established.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. a. CONTROL ROOM evacuation has been initiated.

   AND

   b. Control of **ANY** of the following safety functions is not established from an alternate location within **15 minutes**.

   - Reactivity Control (ability to shut down the reactor and keep it shut down)
   - RCS inventory (ability to cool the core)
   - Secondary heat removal (ability to maintain a heat sink)

Basis:

Generic

The intent of this IC is to capture those events where control of the plant cannot be reestablished in a timely manner. In this case, expeditious transfer of control of safety systems has not occurred (although fission product barrier damage may not yet be indicated).

The intent of the EAL is to establish control of important plant equipment and knowledge of important plant parameters in a timely manner. Primary emphasis should be placed on those components and instruments that supply protection for and information about safety functions. Typically, these safety functions are reactivity control (ability to shutdown the reactor and maintain it shutdown), RCS inventory (ability to cool the core), and secondary heat removal (ability to maintain a heat sink).

The determination of whether or not control is established at the remote shutdown panel is based on EMERGENCY DIRECTOR judgment. The EMERGENCY DIRECTOR is expected to make a reasonable, informed judgment within the site specific time for transfer that the licensee has control of the plant from the remote shutdown panel.

The site specific time for transfer is based on analysis or assessments as to how quickly control must be reestablished without core uncovering and/or core damage. This time should not exceed 15 minutes without additional justification.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HS2 (continued)

Site Specific

The 15 minute time for transfer is based on analysis or assessments as to how quickly control must be reestablished without core uncovering and/or core damage. The 15 minute time period starts when either the control of the plant is no longer maintained in the CONTROL ROOM or the last operator has left the CONTROL ROOM.

Basis Reference(s):

1. NEI 99-01 Rev 5, HS2
2. 2OM-53C.4.2.33.1A, Control Room Inaccessibility, Rev 12
3. 2OM-56C.4.B, Alternate Safe Shutdown from Outside Control Room, Rev 30

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA2

INITIATING CONDITION:

CONTROL ROOM evacuation has been initiated.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. CONTROL ROOM evacuation has been initiated.

Basis:

Generic

With the CONTROL ROOM evacuated, additional support, monitoring and direction through the TECHNICAL SUPPORT CENTER and/or other emergency response facilities may be necessary.

Site Specific

2OM-53C.4.2.33.1A specifies conditions under which CONTROL ROOM evacuation may be necessary. This EAL is only applicable when the decision has been made to evacuate the CONTROL ROOM, not when conditions are being evaluated per 2OM-53C.4.2.33.1A.

Basis Reference(s):

1. NEI 99-01 Rev 5, HA5
2. NEI 99-01 Rev 5, FAQ# 28
3. 2OM-53C.4.2.33.1A, Control Room Inaccessibility, Rev 12
4. 2OM-56C.4.B, Alternate Safe Shutdown from Outside Control Room, Rev 30

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA3

INITIATING CONDITION:

Natural or destructive phenomena affecting VITAL AREAS.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. a. Seismic event **> 0.06g (OBE)** acceleration (as indicated by lit lamp on 2ERS-CCC-1, Seismic Instrumentation Central Control Cabinet).

   AND

   b. Earthquake confirmed by **ANY** of the following:

   - Earthquake felt in plant.
   - National Earthquake Center.
   - CONTROL ROOM indication of degraded performance of systems required for the safe shutdown of the plant.

   OR

2. Tornado or high winds **> 80 mph** resulting in **EITHER** of the following:

   - VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

   OR

3. Internal flooding in **Table H-1** areas resulting in **EITHER** of the following:

   - Electrical shock hazard that precludes access to operate or monitor safety equipment.
   - CONTROL ROOM indication of degraded performance of those safety systems.

   OR

4. High river water level **> 705 feet MSL** resulting in **EITHER** of the following:

   - VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

   OR

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA3 (continued)

5. Low river level (LR-1CW-101) **< 650 feet MSL** resulting in CONTROL ROOM indication of degraded performance of safety systems located in **Table H-1** areas.

   OR

6. Turbine failure-generated PROJECTILES resulting in **EITHER** of the following:
   - VISIBLE DAMAGE to or penetration of **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

   OR

7. Vehicle crash resulting in **EITHER** of the following:
   - VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

Table H-1
• Cable Vault and Rod Control Bldg
• Containment Building
• Control Building
• Demin. Water Storage (2FWE-TK210)
• Diesel Generator Building
• Fuel Handling Building
• Intake Structure Pump Cubicles
• Main Steam Valve Room
• Primary Aux. Building (except elev. 773')
• RWST (2QSS-TK21)
• Safeguards Building
• Service Building (except FW Reg Vlv Rm)

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA3 (continued)

Basis:

Generic

These EALs escalate from HU3 in that the occurrence of the event has resulted in VISIBLE DAMAGE to plant structures or areas containing equipment necessary for a safe shutdown, or has caused damage to the safety systems in those structures evidenced by CONTROL ROOM indications of degraded system response or performance. The occurrence of VISIBLE DAMAGE and/or degraded system response is intended to discriminate against lesser events. The initial report should not be interpreted as mandating a lengthy damage assessment prior to classification. No attempt is made in this EAL to assess the actual magnitude of the damage. The significance here is not that a particular system or structure was damaged, but rather, that the event was of sufficient magnitude to cause this degradation.

EALs #2 - #6

These EALs should specify site specific structures or areas that contain safety system, or component and functions required for safe shutdown of the plant. Site specific Safe Shutdown Analysis should be consulted for equipment and plant areas required to establish or maintain safe shutdown.

EAL #1

Seismic events of this magnitude can result in a VITAL AREA being subjected to forces beyond design limits, and thus damage may be assumed to have occurred to plant safety systems.

This threshold should be based on site specific FSAR design basis. See EPRI-sponsored "Guidelines for Nuclear Plant Response to an Earthquake", dated October 1989, for information on seismic event categories.

The National Earthquake Center can confirm if an earthquake has occurred in the area of the plant.

EAL #2

This EAL is based on a tornado striking (touching down) or high winds that have caused VISIBLE DAMAGE to structures containing functions or systems required for safe shutdown of the plant.

The high wind value should be based on site specific FSAR design basis as long as it is within the range of the instrumentation available for wind speed.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA3 (continued)

EAL #3

This EAL addresses the effect of internal flooding caused by events such as component failures, equipment misalignment, or outage activity mishaps. It is based on the degraded performance of systems, or has created industrial safety hazards (e.g., electrical shock) that preclude necessary access to operate or monitor safety equipment. The inability to access, operate or monitor safety equipment represents an actual or substantial potential degradation of the level of safety of the plant.

Flooding as used in this EAL describes a condition where water is entering the room faster than installed equipment is capable of removal, resulting in a rise of water level within the room. Classification of this EAL should not be delayed while CORRECTIVE ACTIONS are being taken to isolate the water source.

The site specific areas include those areas that contain systems required for safe shutdown of the plant, which are not designed to be partially or fully submerged. The plant's IPEEE may provide insight into areas to be considered when developing this EAL.

EAL #4 and 5

This EAL addresses other site specific phenomena that result in VISIBLE DAMAGE to VITAL AREAS or results in indication of damage to safety structures, systems, or components containing functions and systems required for safe shutdown of the plant (such as hurricane, flood, or seiche) that can also be precursors of more serious events.

EAL #6

This EAL addresses the threat to safety related equipment imposed by PROJECTILES generated by main turbine rotating component failures. Therefore, this EAL is consistent with the definition of an ALERT in that the potential exists for actual or substantial potential degradation of the level of safety of the plant.

The site specific list of areas should include all areas containing safety structure, system, or component, their controls, and their power supplies.

EAL #7

This EAL addresses vehicle crashes within the PROTECTED AREA that results in VISIBLE DAMAGE to VITAL AREAS or indication of damage to safety structures, systems, or components containing functions and systems required for safe shutdown of the plant.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA3 (continued)

Site Specific

Table H-1 lists areas that house equipment that is needed to ensure safe shutdown of the plant. Personnel access to those areas may be an important factor in monitoring and controlling equipment operability. Table H-1 includes structures that are in contact with or immediately adjacent to (directly impacts or obstructs) the areas that actually contain the equipment of concern.

EAL #1

The Maximum Probable Earthquake is 0.06g. It is the conservatively determined earthquake and associated ground motion that might reasonably or probably be expected to occur at the nuclear plant site. The Maximum Probable Earthquake is similar to the Operating Basis Earthquake (OBE) terminology used by the NRC.

As defined in the EPRI-sponsored "Guidelines for Nuclear Plant Response to an Earthquake", dated October 1989, a "felt earthquake" is "An earthquake of sufficient intensity such that: (a) the inventory ground motion is felt at the nuclear plant site and recognized as an earthquake based on a consensus of CONTROL ROOM operators on duty at the time, and (b) for plants with operable seismic instrumentation, the seismic switches of the plant are activated."

EAL #2

The wind speed threshold is based on station structural wind load design criteria for a wind velocity of 80 mph at a nominal 30 feet above the ground (the "fastest mile" American Society of Civil Engineers estimation for a 100 year recurrence interval). This is considered ground level windspeed and is consistent with the 35 foot Meteorological sensor location.

Wind speed is obtained from meteorological data in the CONTROL ROOM that is averaged over a 15 minute period to prevent instantaneous wind gusts or fluctuations from affecting the measurement.

EAL #4

A river level greater than 705' mean sea level is consistent with the elevation of the main transformer pad. This river level will permit flooding to occur within the turbine building, although no safety related equipment is expected to be affected at this elevation.

Indicators to support this determination may include:

1) LR-1CW-101, Ohio River Water Level Recorder,
2) Intake Structure river level indication (ruler markings on outside of Intake Building), or
3) Montgomery Lock or National Weather Service reports Montgomery Lower Pool Level Gauge Reading > 52.48 Ft (equivalent to 705' MSL).

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY
HA3 (continued)

Note: Mean Sea Level = Lower Gauge Reading + 652.52 Ft.

Phone numbers to contact Montgomery Lock and the National Weather Service are located on Form 1/2-EPP-IP-1.1.F02.

EAL #5

At a river level of about 650' normal river water or service water pump (full-flow) into the intake bay will be greater than gravity-fed in-flow from the river itself, causing the intake bay water level to drop eventually resulting in intake pump low flow and reduced service life. When river level drops below650', valves may be manually throttled to reduce pump flows in order to prevent a lowering level in the intake bay. The throttled cooling water at this river level will provide for decay heat removal and other normal operating pumps

(i.e., charging) cooling, but cannot provide for sufficient flow for containment coolers and other emergency event equipment. River water level below 650' constitutes a reduced margin of safety state due to cooling flow rates below normal.

EAL #7

This threshold addresses events such as plane, helicopter, train, barge, car or truck crashes, or impact of PROJECTILES into a plant Safe Shutdown VITAL AREA.

Basis Reference(s):

1. NEI 99-01 Rev 5, HA1
2. U2 UFSAR, Section 2.3.1.2.3, Extreme Winds, Rev 19
3. U2 UFSAR Section 2.4.13.5 Design Basis for Substructure Hydrostatic Loading, Rev 19
4. U2 UFSAR Table 3.2-1, Quality Assurance Category I and Seismic Category I Systems and Components, Rev 19
5. U2 UFSAR, Table 3.2-2, Classification of Structures, Rev 19
6. U2 UFSAR Section 3.3.1.1, Design Wind Velocity, Rev 19
7. U2 UFSAR Section 3.7B.1, Seismic Input, Rev 19
8. 1/2OM-53.C.4A.75.4, Acts of Nature, Dam Failure, Rev 7
9. N-779, BVPS Unit 1 and Unit 2 Response to a Dam Failure, Rev 1
10. Form 1/2-EPP-IP-1.1.F02
11. 1OM-45G.4.AAA, Seismic Accelograph Operation

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU3

INITIATING CONDITION:

Natural or destructive phenomena affecting the PROTECTED AREA.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. a. Seismic event as indicated **> 0.01g** acceleration (initiation of the **Accelerograph Recording System** on Ann A10-5H, Init of Seismic Exceed Preset and/or Spectral Accelerations).

   AND

   b. Earthquake confirmed by **EITHER** of the following:

   - Earthquake felt in plant
   - National Earthquake Center

   OR

2. a. Tornado within the PROTECTED AREA.

   OR

   b. High winds **> 80 mph**.

   OR

3. Internal flooding in **Table H-1** areas that has the potential to affect safety related equipment required by Technical Specifications for the current operating mode.

   OR

4. High river water level **> 705 feet MSL**.

   OR

5. Low river water level (LR-1CW-101) **< 650 feet MSL**.

   OR

6. Turbine failure resulting in casing penetration or damage to turbine or generator seals.

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY
HU3 (continued)

Table H-1
• Cable Vault and Rod Control Bldg • Containment Building • Control Building • Demin. Water Storage (2FWE-TK210) • Diesel Generator Building • Fuel Handling Building • Intake Structure Pump Cubicles • Main Steam Valve Room • Primary Aux. Building (except elev. 773') • RWST (2QSS-TK21) • Safeguards Building • Service Building (except FW Reg Vlv Rm)

Basis:

Generic

These EALs are categorized on the basis of the occurrence of an event of sufficient magnitude to be of concern to plant operators.

EAL #1

Damage may be caused to some portions of the site, but should not affect ability of safety functions to operate.

As defined in the EPRI-sponsored "Guidelines for Nuclear Plant Response to an Earthquake," dated October 1989, a "felt earthquake" is "An earthquake of sufficient intensity such that: (a) the vibratory ground motion is felt at the nuclear plant site and recognized as an earthquake based on a consensus of CONTROL ROOM operators on duty at the time, and (b) for plants with operable seismic instrumentation, the seismic switches of the plant are activated."

For most plants with seismic instrumentation, the seismic switches are set at an acceleration of about 0.01g. This EAL should be developed on site specific basis. The method of detection can be based on instrumentation, validated by a reliable source, or operator assessment.

The National Earthquake Center can confirm if an earthquake has occurred in the area of the plant.

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU3 (continued)

EAL #2

This EAL is based on a tornado striking (touching down) or high winds within the PROTECTED AREA.

The high wind value should be based on site specific FSAR design basis as long as it is within the range of the instrumentation available for wind speed.

EAL #3

This EAL addresses the effect of internal flooding caused by events such as component failures, equipment misalignment, or outage activity mishaps.

The site specific areas include those areas that contain systems required for safe shutdown of the plant, which are not designed to be partially or fully submerged. The plant's IPEEE may provide insight into areas to be considered when developing this EAL.

EAL #4 and 5

This EAL addresses other site specific phenomena (such as hurricane, flood, or seiche) that can also be precursors of more serious events.

EAL #6

This EAL addresses main turbine rotating component failures of sufficient magnitude to cause observable damage to the turbine casing or to the seals of the turbine generator. Generator seal damage observed after generator purge does not meet the intent of this EAL because it did not impact normal operation of the plant.

Of major concern is the potential for leakage of combustible fluids (lubricating oils) and gases (hydrogen cooling) to the plant environs. Actual FIRES and flammable gas build up are appropriately classified via HA4, HU4, and HU5.

This EAL is consistent with the definition of an UNUSUAL EVENT while maintaining the anticipatory nature desired and recognizing the risk to non-safety related equipment.

Site Specific

Table H-1 lists areas that house equipment that is needed to ensure safe shutdown of the plant. Personnel access to those areas may be an important factor in monitoring and controlling equipment operability. Table H-1 includes structures that are in contact with or immediately adjacent to (directly impacts or obstructs) the areas that actually contain the equipment of concern.

EAL #1

This threshold is based on the strong-motion seismograph actuation level which is the sensed earthquake threshold of 0.01 g.

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY
HU3 (continued)

EAL #2

The wind speed threshold is based on station structural wind load design criteria for a wind velocity of 80 mph at a nominal 30 feet above the ground (the "fastest mile" American Society of Civil Engineers estimation for a 100 year recurrence interval). This is considered ground level windspeed and is consistent with the 35 foot Meteorological sensor location.

Wind speed is obtained from meteorological data in the CONTROL ROOM that is averaged over a 15 minute period to prevent instantaneous wind gusts or fluctuations from affecting the measurement.

EAL #4

A river level greater than 705' mean sea level limits operator access to the Main Intake Structure. However, all safety related equipment is protected from external flooding to elevation 730' mean sea level.

Indicators to support this determination may include:

1) LR-1CW-101, Ohio River Water Level Recorder,
2) Intake Structure river level indication (ruler markings on outside of Intake Building), or
3) Montgomery Lock or National Weather Service reports Montgomery Lower Pool Level Gauge Reading > 52.48 Ft (equivalent to 705' MSL).

Note: Mean Sea Level = Lower Gauge Reading + 652.52 Ft.

Phone numbers to contact Montgomery Lock and the National Weather Service are located on Form 1/2-EPP-IP-1.1.F02.

EAL #5

At a river level of about 650' normal river water or service water pump (full-flow) into the intake bay will be greater than gravity-fed in-flow from the river itself, causing the intake bay water level to drop eventually resulting in intake pump low flow and reduced service life. When river level drops below 650', valves may be manually throttled to reduce pump flows in order to prevent a lowering level in the intake bay. The throttled cooling water at this river level will provide for decay heat removal and other normal operating pumps (i.e., charging), but cannot provide for containment coolers and other emergency event equipment. River water level below 650' constitutes a reduced margin of safety state due to cooling flow rates below normal.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU3 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, HU1
2. U2 UFSAR, Section, 2.4.2.2, Flood Design Considerations, Rev 19
3. U2 UFSAR, Section, 2.4.3, Probable Maximum Flood on Streams and Rivers, Rev 19
4. U2 UFSAR, Appendix 2.4A, Analysis of Flood Heights Ohio River at Shippingport, PA, Rev 19
5. U2 UFSAR, Section 2.4.11.1, Low Flow in Streams, Rev 19
6. U2 UFSAR Table 3.2-1, Quality Assurance Category I and Seismic Category I Systems and Components, Rev 19
7. U2 UFSAR, Table 3.2-2, Classification of Structures, Rev 19
8. 1/2OM-53.C.4A.75.4, Acts of Nature, Dam Failure, Rev 7
9. N-779, BVPS Unit 1 and Unit 2 Response to a Dam Failure, Rev 1
10. Form 1/2-EPP-IP-1.1.F02
11. 1OM-45G.4.AAA, Seismic Accelograph Operation

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA4

INITIATING CONDITION:

FIRE or EXPLOSION affecting the operability of plant safety systems required to establish or maintain safe shutdown.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. FIRE or EXPLOSION resulting in **EITHER** of the following:
   - VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components.
   - CONTROL ROOM indication of degraded performance of those safety systems.

Table H-1
• Cable Vault and Rod Control Bldg
• Containment Building
• Control Building
• Demin. Water Storage (2FWE-TK210)
• Diesel Generator Building
• Fuel Handling Building
• Intake Structure Pump Cubicles
• Main Steam Valve Room
• Primary Aux. Building (except elev. 773')
• RWST (2QSS-TK21)
• Safeguards Building
• Service Building (except FW Reg Vlv Rm)

Basis:

Generic

VISIBLE DAMAGE is used to identify the magnitude of the FIRE or EXPLOSION and to discriminate against minor FIRES and EXPLOSIONs.

The reference to structures containing safety systems or components is included to discriminate against FIRES or EXPLOSIONS in areas having a low probability of affecting safe operation. The significance here is not that a safety system was degraded but the fact that the FIRE or EXPLOSION was large enough to cause damage to these systems.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA4 (continued)

The use of VISIBLE DAMAGE should not be interpreted as mandating a lengthy damage assessment prior to classification. The declaration of an ALERT and the activation of the TECHNICAL SUPPORT CENTER will provide the EMERGENCY DIRECTOR with the resources needed to perform detailed damage assessments.

The EMERGENCY DIRECTOR also needs to consider any security aspects of the EXPLOSION.

This EAL should specify site specific structures or areas that contain safety system, or component and functions required for safe shutdown of the plant. Site specific Safe Shutdown Analysis should be consulted for equipment and plant areas required to establish or maintain safe shutdown.

Site Specific

Table H-1 lists areas that house equipment that is needed to ensure safe shutdown of the plant. Personnel access to those areas may be an important factor in monitoring and controlling equipment operability. Table H-1 includes structures that are in contact with or immediately adjacent to (directly impacts or obstructs) the areas that actually contain the equipment of concern.

A steam line break or steam EXPLOSION that damages permanent structures or equipment in one of these areas would be classified under this EAL.

Basis Reference(s):

1. NEI 99-01 Rev 5, HA2
2. U2 UFSAR Table 3.2-1, Quality Assurance Category I and Seismic Category I Systems and Components, Rev 19
3. U2 UFSAR, Table 3.2-2, Classification of Structures, Rev 19

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU4

INITIATING CONDITION:

FIRE within the PROTECTED AREA not extinguished within 15 minutes of detection or EXPLOSION within the PROTECTED AREA.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Notes:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the duration has exceeded, or will likely exceed, the applicable time.
- Immediately adjacent to applies to FIRES that directly impact or obstruct the areas of concern.

1. FIRE not extinguished within **15 minutes** of CONTROL ROOM notification or verification of a CONTROL ROOM FIRE alarm in actual contact with or immediately adjacent to **ANY** of the **Table H-1** areas.

Table H-1
• Cable Vault and Rod Control Bldg
• Containment Building
• Control Building
• Demin. Water Storage (2FWE-TK210)
• Diesel Generator Building
• Fuel Handling Building
• Intake Structure Pump Cubicles
• Main Steam Valve Room
• Primary Aux. Building (except elev. 773')
• RWST (2QSS-TK21)
• Safeguards Building
• Service Building (except FW Reg Vlv Rm)

OR

2. EXPLOSION within the PROTECTED AREA.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU4 (continued)

Basis:

Generic

This EAL addresses the magnitude and extent of FIRES or EXPLOSIONs that may be potentially significant precursors of damage to safety systems. It addresses the FIRE or EXPLOSION, and not the degradation in performance of affected systems that may result.

As used here, detection is visual observation and report by plant personnel or sensor alarm indication.

EAL #1

The 15 minute time period begins with a credible notification that a FIRE is occurring, or indication of a FIRE detection system alarm/actuation. Verification of a FIRE detection system alarm/actuation includes actions that can be taken within the CONTROL ROOM or other nearby site specific location to ensure that it is not spurious. An alarm is assumed to be an indication of a FIRE unless it is disproved within the 15 minute period by personnel dispatched to the scene. In other words, a personnel report from the scene may be used to disprove a sensor alarm if received within 15 minutes of the alarm, but shall not be required to verify the alarm.

The intent of this 15 minute duration is to size the FIRE and to discriminate against small FIRES that are readily extinguished (e.g., smoldering waste paper basket).

The site specific list should be limited and applies to buildings and areas in actual contact with or immediately adjacent to VITAL AREAS or other significant buildings or areas. The intent of this IC is not to include buildings (i.e., warehouses) or areas that are not in actual contact with or immediately adjacent to VITAL AREAS. This excludes FIRES within administration buildings, waste-basket FIRES, and other small FIRES of no safety consequence. Immediately adjacent implies that the area immediately adjacent contains or may contain equipment or cabling that could impact equipment located in VITAL AREAS or the FIRE could damage equipment inside VITAL AREAS or that precludes access to VITAL AREAS.

EAL #2

This EAL addresses only those EXPLOSIONs of sufficient force to damage permanent structures or equipment within the PROTECTED AREA.

No attempt is made to assess the actual magnitude of the damage. The occurrence of the EXPLOSION is sufficient for declaration.

The EMERGENCY DIRECTOR also needs to consider any security aspects of the EXPLOSION, if applicable.

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU4 (continued)

Site Specific

Table H-1 lists areas that house equipment that is needed to ensure safe shutdown of the plant. Personnel access to those areas may be an important factor in monitoring and controlling equipment operability. Table H-1 includes structures that are in contact with or immediately adjacent to (directly impacts or obstructs) the areas that actually contain the equipment of concern.

For the purposes of declaring an emergency event, the term "extinguished" means no visible flames.

A steam line break or steam EXPLOSION that damages permanent structures or equipment in a PROTECTED AREA would be classified under this EAL.

Basis Reference(s):

1. NEI 99-01 Rev 5, HU2
2. U2 UFSAR, Table 3.2-1, Quality Assurance Category I and Seismic Category I Systems and Components, Rev 19
3. U2 UFSAR, Table 3.2-2, Classification of Structures, Rev 19

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA5

INITIATING CONDITION:

Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of operable equipment required to maintain safe operations or safely shutdown the reactor.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Notes:

- If the equipment in the stated area was already inoperable, or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event.
- This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area.

1. Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of systems required to maintain safe operations or safely shutdown the reactor.

Basis:

Generic

Gases in a VITAL AREA can affect the ability to safely operate or safely shutdown the reactor.

The fact that SCBA may be worn does not eliminate the need to declare the event.

Declaration should not be delayed for confirmation from atmospheric testing if the atmosphere poses an immediate threat to life and health or an immediate threat of severe exposure to gases. This could be based upon documented analysis, indication of personnel ill effects from exposure, or operating experience with the hazards.

If the equipment in the stated area is already inoperable or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event.

This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area.

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY
HA5 (continued)

An asphyxiant is a gas capable of reducing the level of oxygen in the body to dangerous levels. Most commonly, asphyxiants work by merely displacing air in an enclosed environment. This reduces the concentration of oxygen below the normal level of around 19%, which can lead to breathing difficulties, unconsciousness or even death.

An uncontrolled release of flammable gasses within a facility structure has the potential to affect safe operation of the plant by limiting either operator or equipment operations due to the potential for ignition and resulting equipment damage/personnel injury. Flammable gases, such as hydrogen and acetylene, are routinely used to maintain plant systems (hydrogen) or to repair equipment/components (acetylene - used in welding). This EAL assumes concentrations of flammable gasses which can ignite/support combustion.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HA3
2. NEI 99-01 Rev 5, FAQ# 24

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU5

INITIATING CONDITION:

Release of toxic, corrosive, asphyxiant or flammable gases deemed detrimental to NORMAL PLANT OPERATIONS.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

Note: This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area.

1. Toxic, corrosive, asphyxiant or flammable gases in amounts that have or could adversely affect NORMAL PLANT OPERATIONS.

   OR

2. Report by local, county or state officials for evacuation or sheltering of site personnel based on an OFFSITE event.

Basis:

Generic

This EAL is based on the release of toxic, corrosive, asphyxiant or flammable gases of sufficient quantity to affect NORMAL PLANT OPERATIONS.

The fact that SCBA may be worn does not eliminate the need to declare the event.

This IC is not intended to require significant assessment or quantification. It assumes an uncontrolled process that has the potential to affect plant operations. This would preclude small or incidental releases, e.g. handheld FIRE extinguishers, or releases that do not impact structures needed for plant operation.

This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area.

An asphyxiant is a gas capable of reducing the level of oxygen in the body to dangerous levels. Most commonly, asphyxiants work by merely displacing air in an enclosed environment. This reduces the concentration of oxygen below the normal level of around 19%, which can lead to breathing difficulties, unconsciousness or even death.

Site Specific

None

RECOGNITION CATEGORY

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU5 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, HU3
2. NEI 99-01 Rev 5, FAQ# 24

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HG6

INITIATING CONDITION:

Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of a GENERAL EMERGENCY.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PROTECTIVE ACTION GUIDE exposure levels OFFSITE for more than the immediate site area.

Basis:

Generic

This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the EMERGENCY DIRECTOR to fall under the EMERGENCY CLASSIFICATION LEVEL description for GENERAL EMERGENCY.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HG2
2. EPA-400, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HS6

INITIATING CONDITION:

Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of a SITE AREA EMERGENCY.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts: (1) toward site personnel or equipment that could lead to the likely failure of or, (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PROTECTIVE ACTION GUIDE exposure levels beyond the site boundary.

Basis:

Generic

This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the EMERGENCY DIRECTOR to fall under the EMERGENCY CLASSIFICATION LEVEL description for SITE AREA EMERGENCY.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HS3
2. EPA-400, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HA6

INITIATING CONDITION:

Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an ALERT.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA PROTECTIVE ACTION GUIDE exposure levels.

Basis:

Generic

This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the EMERGENCY DIRECTOR to fall under the ALERT EMERGENCY CLASSIFICATION LEVEL.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HA6
2. EPA-400, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

HU6

INITIATING CONDITION:

Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an UNUSUAL EVENT.

Operating Mode Applicability:

1, 2, 3, 4, 5, 6, D

EALs:

1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring OFFSITE response or monitoring are expected unless further degradation of safety systems occurs.

Basis:

Generic

This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the EMERGENCY DIRECTOR to fall under the UNUSUAL EVENT EMERGENCY CLASSIFICATION LEVEL.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, HU5

RECOGNITION CATEGORY
HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY
E-HU1

INITIATING CONDITION:

Damage to a loaded cask CONFINEMENT BOUNDARY.

Operating Mode Applicability:

Not Applicable

EALs:

1. Damage to a loaded cask CONFINEMENT BOUNDARY.

Basis:

Generic

An UNUSUAL EVENT in this IC is categorized on the basis of the occurrence of an event of sufficient magnitude that a loaded cask CONFINEMENT BOUNDARY is damaged or violated. This includes classification based on a loaded fuel storage cask CONFINEMENT BOUNDARY loss leading to the degradation of the fuel during storage or posing an operational safety problem with respect to its removal from storage.

The results of the ISFSI Safety Analysis Report (SAR) per NUREG 1536 or SAR referenced in the cask's Certificate of Compliance and the related NRC Safety Evaluation Report identify natural phenomena events and accident conditions that could potentially affect the CONFINEMENT BOUNDARY. This EAL addresses a dropped cask, a tipped over cask, EXPLOSION, PROJECTILE damage, FIRE damage or natural phenomena affecting a cask (e.g., seismic event, tornado, etc.).

Site Specific

None.

Basis Reference(s):

1. NEI 99-01 Rev 5, E-HU1

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SG1

INITIATING CONDITION:

Prolonged loss of all OFFSITE and all ONSITE AC power to emergency busses.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

1. a. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses.

   AND

   b. **EITHER** of the following:

   - Restoration of **EITHER** the AE 4KV emergency bus **OR** DF 4KV emergency bus within **4 hours** is not likely.
   - Core Cooling - Red entry conditions met.

Basis:

Generic

Loss of all AC power to emergency busses compromises all plant safety systems requiring electric power including RHR, ECCS, Containment Heat Removal, and the Ultimate Heat Sink. Prolonged loss of all AC power to emergency busses will lead to loss of fuel clad, RCS, and containment, thus warranting declaration of a GENERAL EMERGENCY.

The hours to restore AC power can be based on a site blackout coping analysis performed in conformance with 10 CFR 50.63 and Regulatory Guide 1.155, "Station Blackout," as available. Appropriate allowance for OFFSITE emergency response including evacuation of surrounding areas should be considered. Although this IC may be viewed as redundant to the Fission Product Barrier Degradation IC, its inclusion is necessary to better assure timely recognition and emergency response.

This IC is specified to assure that in the unlikely event of a prolonged station blackout, timely recognition of the seriousness of the event occurs and that declaration of a GENERAL EMERGENCY occurs as early as is appropriate, based on a reasonable assessment of the event trajectory.

The likelihood of restoring at least one emergency bus should be based on a realistic appraisal of the situation since a delay in an upgrade decision based on only a chance of mitigating the event could result in a loss of valuable time in preparing and implementing public PROTECTIVE ACTIONS.

In addition, under these conditions, Fission Product Barrier monitoring capability may be degraded.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SG1 (continued)

Site Specific

OFFSITE AC power is considered AC power supplied from the grid.

A cross-tie connecting the 4,160 V normal busses 1A and 1D of BVPS-1, and 2A and 2D of BVPS-2 provides the capability to provide limited power to the emergency busses at one unit from either of the emergency diesel generators (EDGs) at the other unit.

The design of the SBO cross-tie circuit conforms with guidance provided by Regulatory Guide 1.155 and NUMARC 87-00. The circuit consists of four locally operated 4,160 V breakers installed at switchgear busses 1A, 1D, 2A, and 2D, and interconnected by 5 kV power cables protected against the effects of likely weather-related events. The normal to emergency 4,160 V bus connections, described in Sections 8.3.1.1.2 and 8.3.1.1.6, complete the circuit to the AAC power source.

The cross-tie between the normal 4,160 V busses is disconnected (breakers racked out) during normal plant operation and requires manual operator action to place into service during SBO conditions. Energization of the cross-tie and startup of equipment to cope with a SBO is administratively controlled and procedurally addressed by EMERGENCY OPERATING PROCEDURES for BVPS-1 and BVPS-2.

Basis Reference(s):

1. NEI 99-01 Rev 5, SG1
2. U2 UFSAR Section 8.3.1.1.19, Station Blackout (SBO) 4,160 V Cross-Tie, Rev 19
3. DEC-0246, Coping Duration for Station Black Out, Rev 0

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS1

INITIATING CONDITION:

Loss of all OFFSITE and all ONSITE AC power to emergency busses for 15 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Notes:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.
- Credit cannot be taken for emergency busses being powered from the other unit's emergency diesel generators.

1. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes** or longer.

Basis:

Generic

Loss of all AC power to emergency busses compromises all plant safety systems requiring electric power including RHR, ECCS, Containment Heat Removal and the Ultimate Heat Sink. Prolonged loss of all AC power to emergency busses will lead to loss of fuel clad, RCS, and containment, thus this event can escalate to a GENERAL EMERGENCY.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of OFFSITE power.

At multi-unit stations, the EALs should allow credit for operation of installed design features, such as cross-ties or swing diesels, provided that abnormal or EMERGENCY OPERATING PROCEDURES address their use. However, these stations must also consider the impact of this condition on other shared safety functions in developing the site specific EAL.

Plants that have a proceduralized capability to cross-tie AC power from an OFFSITE power supply of a companion unit may take credit for the redundant power source in the associated EAL for this IC.

Site Specific

OFFSITE AC power is considered AC power supplied from the grid.

A cross-tie connecting the 4,160 V normal busses 1A and 1D of BVPS-1, and 2A and 2D of BVPS-2 provides the capability to provide limited power to the emergency busses at one unit from either of the emergency diesel generators (EDGs) at the other unit.

The design of the SBO cross-tie circuit conforms with guidance provided by Regulatory Guide 1.155 and NUMARC 87-00. The circuit consists of four locally operated 4,160 V breakers installed at switchgear busses 1A, 1D, 2A, and 2D, and interconnected by 5 kV power cables protected against the effects of likely weather-related events. The normal to emergency 4,160 V bus connections, described in Sections 8.3.1.1.2 and 8.3.1.1.6, complete the circuit to the AAC power source.

The cross-tie between the normal 4,160 V busses is disconnected (breakers racked out) during normal plant operation and requires manual operator action to place into service during SBO conditions. Energization of the cross-tie and startup of equipment to cope with a SBO is administratively controlled and procedurally addressed by EMERGENCY OPERATING PROCEDURES for BVPS-1 and BVPS-2.

Credit cannot be taken for emergency busses being powered from the other unit's emergency diesel generators.

Basis Reference(s):

1. NEI 99-01 Rev 5, SS1

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SA1

INITIATING CONDITION:

AC power capability to emergency busses reduced to a single source for 15 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. a. AC power to AE and DF 4KV emergency busses is reduced to a single power source for **15 minutes** or longer.

   AND

   b. Any additional single power source failure will result in loss of **ALL** AC power to **BOTH** AE and DF 4KV emergency busses.

Basis:

Generic

The condition indicated by this IC is the degradation of the OFFSITE and ONSITE AC power systems such that any additional single failure would result in a loss of all AC power to emergency buses. This condition could occur due to a loss of OFFSITE power with a concurrent failure of all but one emergency generator to supply power to its emergency busses. Another related condition could be the loss of all OFFSITE power and loss of ONSITE emergency generators with only one train of emergency busses being backfed from the unit main generator, or the loss of ONSITE emergency generators with only one train of emergency busses being backfed from OFFSITE power.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of power.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, SA5
2. NEI 99-01 Rev 5, FAQ# 36

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU1

INITIATING CONDITION:

Loss of all OFFSITE AC power to emergency busses for 15 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

1. Loss of **ALL** OFFSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes** or longer.

Basis:

Generic

Prolonged loss of OFFSITE AC power reduces required redundancy and potentially degrades the level of safety of the plant by rendering the plant more vulnerable to a complete loss of AC power to emergency busses.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of OFFSITE power.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, SU1

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS2

INITIATING CONDITION:

Loss of all vital DC power for 15 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

1. **< 110.4 VDC** on **ALL** safety related DC busses (2-1, 2-2, 2-3 and 2-4) for **15 minutes** or longer.

Basis:

Generic

Loss of all DC power compromises ability to monitor and control plant safety functions. Prolonged loss of all DC power will cause core uncovering and loss of containment integrity when there is significant decay heat and sensible heat in the reactor system.

Site specific bus voltage should be based on the minimum bus voltage necessary for the operation of safety related equipment. This voltage value should incorporate a margin of at least 15 minutes of operation before the onset of inability to operate those loads. This voltage is usually near the minimum voltage selected when battery sizing is performed. Typically the value for the entire battery set is approximately 105 VDC. For a 60 cell string of batteries the cell voltage is typically 1.75 Volts per cell. For a 58 string battery set the minimum voltage is typically 1.81 Volts per cell.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Site Specific

The safety-related 125 VDC power distribution system is composed of the following [T.S. Bases 3.8.5 & UFSAR Section 8.3.2]:

- two 1700 amp-hour [BAT-2-1 & -2] and two 1140 amp-hour [BAT-2-3 & -4] 125 VDC batteries
- four 100 amp battery chargers
- four 125 VDC Switchboards [DC-SWBD2-1, -2, -3 & -4]
- ten 125 VDC distribution panels (four each for [DC-SWBD2-1 & -2] and one each for [DC-SWBD2-3 & -4])

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS2 (continued)

The system also supports a 120 VAC Vital Bus System (that powers vital plant instrumentation), which is powered from 125 VDC / 120 VAC inverters (or by rectified 480 VAC power being inverted, when AC power is available).

The 125 VDC and 120 VAC Vital Bus Systems are designed to provide redundant and reliable power to components and systems that are essential to plant safety, including the Reactor Protective System (RPS) and the Engineered Safety Feature Actuation System (ESFAS) (T.S. Bases 3.8.8).

The station batteries supply essential and nonessential 125 VDC loads and distribution panels during a loss of the battery charger supply. The batteries are sized to supply the station DC and AC vital bus loads for a period of 2 hours without AC power (UFSAR 8.3.2.1.3).

The 60 cell station batteries are rated at 1700 amp-hour capacity [BAT-2-1 & -2] or 1140 amp-hour capacity [BAT-2-3 & -4] to an end voltage of 1.84 volts per cell, i.e., 110.4 VDC battery voltage (UFSAR 8.3.2.1.3).

The system also supports a 120 VAC Vital Bus System (that powers vital plant instrumentation), which is powered from 125 VDC / 120 VAC inverters (or by rectified 480 VAC power being inverted, when AC power is available).

The 125 VDC and 120 VAC Vital Bus Systems are designed to provide redundant and reliable power to components and systems that are essential to plant safety, including the Reactor Protective System (RPS) and the Engineered Safety Feature Actuation System (ESFAS) (T.S. Bases 3.8.8).

The station batteries supply essential and nonessential 125 VDC loads and distribution panels during a loss of the battery charger supply. The batteries are sized to supply the station DC and AC vital bus loads for a period of 2 hours without AC power (UFSAR 8.3.2.1.3).

The 60 cell station batteries are rated at 1700 amp-hour capacity [BAT-2-1 & -2] or 1140 amp-hour capacity [BAT-2-3 & -4] to an end voltage of 1.84 volts per cell, i.e., 110.4 VDC battery voltage (UFSAR 8.3.2.1.3).

SS2 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, SS3
2. U2 UFSAR Section 8.3.2, DC Power Systems, Rev 19
3. U2 UFSAR Section 8.3.2.1.3, DC Power System Arrangement and Sizing, Rev 19
4. U2 UFSAR Section 8.3.2.2, DC Power Systems Analysis, Rev 19
5. BVPS-1&2 Technical Specification 3.8.7, Inverters – Operating, Rev 0

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SG3

INITIATING CONDITION:

Automatic trip and all manual actions failed to shutdown the reactor and indication of an extreme challenge to the ability to cool the core exists.

Operating Mode Applicability:

1, 2

EALs:

1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power **> 5%.**

   AND

   b. **ALL** manual trip actions failed to shutdown the reactor as indicated by reactor power **> 5%.**

   AND

   c. **EITHER** of the following has occurred:

   - Core Cooling - Red entry conditions met.
   - Heat Sink - Red entry conditions met..

Basis:

Generic

Under these conditions, the reactor is producing more heat than the maximum decay heat load for which the safety systems are designed and efforts to bring the reactor subcritical are unsuccessful.

The reactor should be considered shutdown when it is producing less heat than the maximum decay heat load for which the safety systems are designed (typically 3 to 5% power). For plants using CSFSTs, this EAL equates to the criteria used to determine a VALID Subcriticality Red Path.
For PWRs, the extreme challenge to the ability to cool the core is intended to mean that the core exit temperatures are at or approaching 1200° F or that the reactor vessel water level is below the top of active fuel. For plants using CSFSTs, this EAL equates to a Core Cooling Red condition combined with a Subcriticality Red condition.

Another consideration is the inability to initially remove heat during the early stages of this sequence. For PWRs, if emergency feedwater flow is insufficient to remove the amount of heat required by design from at least one steam generator, an extreme challenge should be considered to exist. For plants using CSFSTs, this EAL equates to a Heat Sink Red condition combined with a Subcriticality Red condition.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SG3 (continued)

In the event either of these challenges exists at a time that the reactor has not been brought below the power associated with the safety system design a core melt sequence exists. In this situation, core degradation can occur rapidly. For this reason, the GENERAL EMERGENCY declaration is intended to be anticipatory of the fission product barrier table declaration to permit maximum OFFSITE intervention time.

Site Specific

This EAL considers all actions to trip the reactor at and away from the reactor control console.

Basis Reference(s):

1. NEI 99-01 Rev 5, SG2
2. NEI 99-01 Rev 5, FAQ# 31

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS3

INITIATING CONDITION:

Automatic trip and manual actions taken within the Controls Area (CA) failed to shutdown the reactor.

Operating Mode Applicability:

1, 2

EALs:

1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power **> 5%**.

   AND

   b. Manual trip actions taken within the Controls Area (CA) failed to shutdown the reactor as indicated by reactor power **> 5%.**

Basis:

Generic

Under these conditions, the reactor is producing more heat than the maximum decay heat load for which the safety systems are designed and efforts to bring the reactor subcritical are unsuccessful. A SITE AREA EMERGENCY is warranted because conditions exist that lead to IMMINENT loss or potential loss of both fuel clad and RCS.

The reactor should be considered shutdown when it is producing less heat than the maximum decay heat load for which the safety systems are designed (typically 3 to 5% power).

Manual scram (trip) actions taken at the reactor control console are any set of actions by the reactor operator(s) at which causes or should cause control rods to be rapidly inserted into the core and shuts down the reactor.

Manual scram (trip) actions are not considered successful if action away from the reactor control console is required to scram (trip) the reactor. This EAL is still applicable even if actions taken away from the reactor control console are successful in shutting the reactor down because the design limits of the fuel may have been exceeded or because of the gross failure of the Reactor Protection System to shutdown the plant.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, SS2
2. NEI 99-01 Rev 5, FAQ# 31

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SA3

INITIATING CONDITION:

Automatic trip failed to shutdown the reactor and the manual actions taken from the Controls Area (CA) are successful in shutting down the reactor.

Operating Mode Applicability:

1, 2

EALs:

1. a. An automatic reactor trip failed to shutdown the reactor.

   AND

   b. Manual trip actions taken within the Controls Area (CA) successfully shutdown the reactor as indicated by reactor power **≤ 5%**.

Basis:

Generic

The reactor should be considered shutdown when it is producing less heat than the maximum decay heat load for which the safety systems are designed (typically 3 to 5% power).

Manual scram (trip) actions taken at the reactor control console are any set of actions by the reactor operator(s) which causes or should cause control rods to be rapidly inserted into the core and shuts down the reactor.

If the manual scram (trip) switches/pushbuttons on the CONTROL ROOM console panels are considered an automatic input into the Reactor Protection System, a failure to scram (trip) without any other automatic input would make this threshold applicable.

This condition indicates failure of the automatic protection system to scram (trip) the reactor. This condition is more than a potential degradation of a safety system in that a front line automatic protection system did not function in response to a scram (trip) signal. Thus the plant safety has been compromised because design limits of the fuel may have been exceeded. An ALERT is indicated because conditions may exist that lead to potential loss of fuel clad or RCS and because of the failure of the Reactor Protection System to automatically shutdown the plant.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, SA2
2. NEI 99-01 Rev 5, FAQ#s 31 and 35

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU3

INITIATING CONDITION:

Inadvertent criticality.

Operating Mode Applicability:

3, 4

EALs:

1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.

Basis:

Generic

This IC addresses inadvertent criticality events. This IC indicates a potential degradation of the level of safety of the plant, warranting an UNUSUAL EVENT EMERGENCY CLASSIFICATION LEVEL. This IC excludes inadvertent criticalities that occur during planned reactivity changes associated with reactor startups (e.g., criticality earlier than estimated).

This condition can be identified using the startup rate monitor. The term "sustained" is used in order to allow exclusion of expected short term positive startup rates from planned control rod movements (such as shutdown bank withdrawal). These short term positive startup rates are the result of the increase in neutron population due to subcritical multiplication.

Site Specific

This condition can be identified using:

- Source Range Detectors N-31 & N-32
- Intermediate Range Detectors N-35 & N-36
- Scaler Timer N-34 (Audible Count Rate)
- Gamma Metrics N-54A & 54B (refer to UFSAR 4.4.6.6.)

Basis Reference(s):

1. NEI 99-01 Rev 5, SU8
2. Regulatory Guide 8.12, Criticality Accident Alarm Systems

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS4

INITIATING CONDITION:

Inability to monitor a significant transient in progress.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. a. Loss of **> 75%** of **EITHER** of the following for **15 minutes** or longer:
   - CONTROL ROOM Annunciator Panels (A1, A2, A4 - A11).

     OR
   - CONTROL ROOM critical safety function indications (Table S-1).

Table S-1: Critical Safety Functions
• Reactivity Control (ability to shut down the reactor and keep it shut down)
• RCS inventory (ability to cool the core)
• Secondary heat removal (ability to maintain a heat sink)

AND

b. A **Table S-2** significant transient is in progress.

Table S-2: Significant Transients
• Automatic turbine runback > 25% thermal reactor power
• Electrical load rejection > 25% full electrical load
• Reactor trip
• Safety Injection actuation

AND

c. COMPENSATORY INDICATIONS are unavailable.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS4 (continued)

Basis:

Generic

This IC is intended to recognize the threat to plant safety associated with the complete loss of capability of the CONTROL ROOM staff to monitor plant response to a significant transient.

Quantification is arbitrary, however, it is estimated that if approximately 75% of the safety system annunciators or indicators are lost, there is an increased risk that a degraded plant condition could go undetected. It is not intended that plant personnel perform a detailed count of the instrumentation lost but use the value as a judgment threshold for determining the severity of the plant conditions. It is also not intended that the Shift Supervisor be tasked with making a judgment decision as to whether additional personnel are required to provide increased monitoring of system operation.

It is further recognized that most plant designs provide redundant safety system indication powered from separate uninterruptible power supplies. While failure of a large portion of annunciators is more likely than a failure of a large portion of indications, the concern is included in this EAL due to difficulty associated with assessment of plant conditions. The loss of specific, or several, safety system indicators should remain a function of that specific system or component operability status. This will be addressed by the specific Technical Specification. The initiation of a Technical Specification imposed plant shutdown related to the instrument loss will be reported via 10 CFR 50.72. If the shutdown is not in compliance with the Technical Specification action, the UNUSUAL EVENT is based on SU5, "Inability to Reach Required Shutdown Within Technical Specification Limits."

A SITE AREA EMERGENCY is considered to exist if the CONTROL ROOM staff cannot monitor safety functions needed for protection of the public while a significant transient is in progress.

Site specific annunciators for this EAL should be limited to include those identified in the Abnormal Operating Procedures, in the EMERGENCY OPERATING PROCEDURES, and in other EALs (e.g., area, process, and/or effluent rad monitors, etc.)

Site specific indications needed to monitor safety functions necessary for protection of the public must include CONTROL ROOM indications, computer generated indications and dedicated annunciation capability.

The specific indications should be those used to determine such functions as the ability to shut down the reactor, maintain the core cooled, to maintain the Reactor Coolant System intact, maintain the spent fuel cooled, and to maintain containment intact.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SS4 (continued)

A significant transient is an UNPLANNED event involving one or more of the following site specific criteria: (1) automatic turbine runback greater than 25% thermal reactor power, (2) electrical load rejection greater than 25% full electrical load, (3) Reactor trip, or (4) Safety Injection activation.

COMPENSATORY INDICATIONS in this context include computer based information such as SPDS. This should include all computer systems available for this use depending on specific plant design and subsequent retrofits.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Site Specific

CONTROL ROOM safety system annunciators are provided on annunciator panels A1, A2 and A4 through A11.

Basis Reference(s):

1. NEI 99-01 Rev 5, SS6
2. NEI 99-01 Rev 5, FAQ# 39

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SA4

INITIATING CONDITION:

Loss of safety system annunciation or indication in the CONTROL ROOM with either: (1) a significant transient in progress, or (2) COMPENSATORY INDICATIONS are unavailable.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. a. Loss of **> 75%** of **EITHER** of the following for **15 minutes** or longer:

- CONTROL ROOM Annunciator Panels (A1, A2, A4 - A11).

  OR

- CONTROL ROOM critical safety function indications (Table S-1).

Table S-1: Critical Safety Functions
• Reactivity Control (ability to shut down the reactor and keep it shut down)
• RCS inventory (ability to cool the core)
• Secondary heat removal (ability to maintain a heat sink)

AND

b. **EITHER** of the following:

- A **Table S-2** significant transient is in progress.

Table S-2: Significant Transients
• Automatic turbine runback > 25% thermal reactor power
• Electrical load rejection > 25% full electrical load
• Reactor trip
• Safety Injection actuation

  OR

- COMPENSATORY INDICATIONS are unavailable.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SA4 (continued)

Basis:

Generic

This IC is intended to recognize the difficulty associated with monitoring changing plant conditions without the use of a major portion of the annunciation or indication equipment during a significant transient.

Recognition of the availability of computer based indication equipment is considered (e.g., SPDS, plant computer, etc.).

Quantification is arbitrary, however, it is estimated that if approximately 75% of the safety system annunciators or indicators are lost, there is an increased risk that a degraded plant condition could go undetected. It is not intended that plant personnel perform a detailed count of the instrumentation lost but use the value as a judgment threshold for determining the severity of the plant conditions. It is also not intended that the Shift Supervisor be tasked with making a judgment decision as to whether additional personnel are required to provide increased monitoring of system operation.

It is further recognized that most plant designs provide redundant safety system indication powered from separate uninterruptible power supplies. While failure of a large portion of annunciators is more likely than a failure of a large portion of indications, the concern is included in this EAL due to difficulty associated with assessment of plant conditions. The loss of specific, or several, safety system indicators should remain a function of that specific system or component operability status. This will be addressed by the specific Technical Specification. The initiation of a Technical Specification imposed plant shutdown related to the instrument loss will be reported via 10 CFR 50.72. If the shutdown is not in compliance with the Technical Specification action, the UNUSUAL EVENT is based on SU5, "Inability to Reach Required Operating Mode Within Technical Specification Limits."

Site specific annunciators or indicators for this EAL must include those identified in the Abnormal Operating Procedures, in the EMERGENCY OPERATING PROCEDURES, and in other EALs (e.g., area, process, and/or effluent rad monitors, etc.).

A significant transient is an UNPLANNED event involving one or more of the following site specific criteria: (1) automatic turbine runback greater than 25% thermal reactor power, (2) electrical load rejection greater than 25% full electrical load, (3) Reactor trip, or (4) Safety Injection activation.

COMPENSATORY INDICATIONS in this context include computer based information such as SPDS. This should include all computer systems available for this use depending on specific plant design and subsequent retrofits.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SA4 (continued)

Site Specific

CONTROL ROOM safety system annunciators are provided on annunciator panels A1, A2 and A4 through A11.

Basis Reference(s):

1. NEI 99-01 Rev 5, SA4
2. NEI 99-01 Rev 5, FAQ# 39

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU4

INITIATING CONDITION:

Loss of safety system annunciation or indication in the CONTROL ROOM for 15 minutes or longer.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

1. Loss of **> 75%** of **EITHER** of the following for **15 minutes** or longer:
   - CONTROL ROOM Annunciator Panels (A1, A2, A4 - A11).

   OR

   - CONTROL ROOM critical safety function indications (Table S-1).

Table S-1: Critical Safety Functions
• Reactivity Control (ability to shut down the reactor and keep it shut down)
• RCS inventory (ability to cool the core)
• Secondary heat removal (ability to maintain a heat sink)

Basis:

Generic

This IC and its associated EAL are intended to recognize the difficulty associated with monitoring changing plant conditions without the use of a major portion of the annunciation or indication equipment.

Recognition of the availability of computer based indication equipment is considered (e.g., SPDS, plant computer, etc.).

Quantification is arbitrary, however, it is estimated that if approximately 75% of the safety system annunciators or indicators are lost, there is an increased risk that a degraded plant condition could go undetected. It is not intended that plant personnel perform a detailed count of the instrumentation lost but use the value as a judgment threshold for determining the severity of the plant conditions.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU4 (continued)

It is further recognized that most plant designs provide redundant safety system indication powered from separate uninterruptible power supplies. While failure of a large portion of annunciators is more likely than a failure of a large portion of indications, the concern is included in this EAL due to difficulty associated with assessment of plant conditions. The loss of specific, or several, safety system indicators should remain a function of that specific system or component operability status. This will be addressed by the specific Technical Specification. The initiation of a Technical Specification imposed plant shutdown related to the instrument loss will be reported via 10 CFR 50.72. If the shutdown is not in compliance with the Technical Specification action, the UNUSUAL EVENT is based on SU5, "Inability to Reach Required Operating Mode Within Technical Specification Limits."

Site specific annunciators or indicators for this EAL must include those identified in the Abnormal Operating Procedures, in the EMERGENCY OPERATING PROCEDURES, and in other EALs (e.g., area, process, and/or effluent rad monitors, etc.).

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Site Specific

CONTROL ROOM safety system annunciators are provided on annunciator panels A1, A2 and A4 through A11.

Basis Reference(s):

1. NEI 99-01 Rev 5, SU3

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU5

INITIATING CONDITION:

Inability to reach required operating mode within Technical Specification limits.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

1. Plant is not brought to required operating mode within Technical Specification LCO action statement time.

Basis:

Generic

Limiting Conditions for Operation (LCOs) require the plant to be brought to a required operating mode when the Technical Specification required configuration cannot be restored. Depending on the circumstances, this may or may not be an emergency or precursor to a more severe condition. In any case, the initiation of plant shutdown required by the site Technical Specifications requires a four hour report under 10 CFR 50.72 (b), Non-emergency events.

The plant is within its safety envelope when being shut down within the allowable action statement time in the Technical Specifications. An immediate UNUSUAL EVENT is required when the plant is not brought to the required operating mode within the allowable action statement time in the Technical Specifications. Declaration of an UNUSUAL EVENT is based on the time at which the LCO specified action statement time period elapses under the site Technical Specifications and is not related to how long a condition may have existed.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, SU2

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU6

INITIATING CONDITION:

Loss of all ONSITE or OFFSITE communications capabilities.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

1. Loss of **ALL** of the following ONSITE communication methods affecting the ability to perform routine operations:
   - Radios.
   - Plant page.
   - Plant telephone System (hardwired).

   OR

2. Loss of **ALL** of the following OFFSITE communications methods affecting the ability to perform OFFSITE notifications:
   - NRC Emergency Notification System – ENS (Red Phone).
   - NRC Health Physics Network – HPN.
   - Commercial telephones (hardwired and wireless).

Basis:

Generic

The purpose of this IC and its associated EALs is to recognize a loss of communications capability that either defeats the plant operations staff ability to perform routine tasks necessary for plant operations or the ability to communicate issues with OFFSITE authorities.

The loss of OFFSITE communications ability is expected to be significantly more comprehensive than the condition addressed by 10 CFR 50.72.

The availability of one method of ordinary OFFSITE communications is sufficient to inform Federal, State, and local authorities of plant problems. This EAL is intended to be used only when extraordinary means (e.g., relaying of information from non-routine radio transmissions, individuals being sent to OFFSITE locations, etc.) are being used to make communications possible.

Site specific list for ONSITE communications loss must encompass the loss of all means of communications (e.g., commercial telephones, sound powered phone systems, plant page systems and radios) routinely used for operations.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU6 (continued)

Site specific list for OFFSITE communications loss must encompass the loss of all means of communications with OFFSITE authorities. This should include the ENS, commercial telephone lines, telecopy transmissions, and dedicated phone systems that are routinely used for OFFSITE emergency notifications.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, SU6

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU7

INITIATING CONDITION:

RCS leakage.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

Note:

- Identified, unidentified and pressure boundary RCS leakage as defined by Technical Specifications.
- Relief valve normal operation should be excluded unless it fails to close and cannot be isolated.

1. Unidentified or pressure boundary leakage **> 10 gpm**.

   OR

2. Identified leakage **> 25 gpm**.

Basis:

Generic

This IC is included as an UNUSUAL EVENT because it may be a precursor of more serious conditions and, as result, is considered to be a potential degradation of the level of safety of the plant. The 10 gpm value for the unidentified or pressure boundary leakage was selected as it is observable with normal CONTROL ROOM indications. Lesser values must generally be determined through time-consuming surveillance tests (e.g., mass balances).

Relief valve normal operation should be excluded from this IC. However, a relief valve that operates and fails to close per design should be considered applicable to this IC if the relief valve cannot be isolated.

The EAL for identified leakage is set at a higher value due to the lesser significance of identified leakage in comparison to unidentified or pressure boundary leakage.

Site Specific

Technical Specifications identifies the specific leakage location that qualifies as RCS leakage and provides the definitions for identified, unidentified and pressure boundary leakage.

Isolating letdown is a standard abnormal operating procedure action and may prevent unnecessary classifications when a non-RCS leakage path such as a CVCS leak exists.

Added generic basis Note for relief valve operation.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU7 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, SU5
2. BVPS-1&2 Technical Specification 1.1, Definitions
3. BVPS-1&2 Technical Specification 3.4.13, RCS Operational Leakage

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU9

INITIATING CONDITION:

Fuel clad degradation.

Operating Mode Applicability:

1, 2, 3, 4

EALs:

1. Letdown Monitor (2CHS-RQ101B) **> 2.98E+03 µCi/cc.**

   OR

2. RCS activity **> 21 µCi/gm** dose equivalent I-131.

Basis:

Generic

This EAL is included because it is a precursor of more serious conditions and, as result, is considered to be a potential degradation of the level of safety of the plant.

EAL #1

This threshold addresses site specific radiation monitor readings that provide indication of a degradation of fuel clad integrity.

EAL #2

This threshold addresses coolant samples exceeding coolant Technical Specifications for transient iodine spiking limits.

Site Specific

EAL #1

This reading is not applicable if letdown is isolated since the monitor isolates with letdown. As such, this reading would be useful only in those events (e.g., RCP locked rotor) in which safety injection and containment isolation do not actuate.

EAL #2

An UNUSUAL EVENT is only warranted when actual fuel clad damage is the cause of the elevated coolant sample (as determined by laboratory confirmation). However, fuel clad damage should be assumed to be the cause of elevated RCS activity unless another cause is known, e.g., RCS chemical decontamination evolution during shutdown results in high activity levels. This EAL and its associated applicability are based on Technical Specifications.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - HOT

SU9 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, SU4
2. BVPS-1&2 Technical Specification 3.4.16, RCS Specific Activity
3. ESR-SFL-88-027, Process Safety Limits and Alarm Setpoints for 2CHS-RQ-101 A/B, Rev 3

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CA1

INITIATING CONDITION:

Loss of all OFFSITE and all ONSITE AC power to emergency busses for 15 minutes or longer.

Operating Mode Applicability:

5, 6, D

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes** or longer.

Basis:

Generic

Loss of all AC power compromises all plant safety systems requiring electric power including Residual Heat Removal, ECCS, Containment Heat Removal, Spent Fuel Heat Removal and the Ultimate Heat Sink.

The event can be classified as an ALERT when in cold shutdown, refueling, or defueled mode because of the significantly reduced decay heat and lower temperature and pressure, increasing the time to restore one of the emergency busses, relative to that specified for the SITE AREA EMERGENCY EAL.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, CA3

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU1

INITIATING CONDITION:

AC power capability to emergency busses reduced to a single source for 15 minutes or longer.

Operating Mode Applicability:

5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. a. AC power to AE and DF 4KV emergency busses is reduced to a single power source for **15 minutes** or longer.

   AND

   b. Any additional single power source failure will result in loss of **ALL** AC power to **BOTH** AE and DF 4KV emergency busses.

Basis:

Generic

The condition indicated by this IC is the degradation of the OFFSITE and ONSITE AC power systems such that any additional single failure would result in a station blackout. This condition could occur due to a loss of OFFSITE power with a concurrent failure of all but one emergency generator to supply power to its emergency busses.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of OFFSITE power.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, CU3
2. NEI 99-01 Rev 5, FAQ# 36

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU2

INITIATING CONDITION:

Loss of required DC power for 15 minutes or longer.

Operating Mode Applicability:

5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. **< 110.4 VDC** on the required DC busses for **15 minutes** or longer.

Basis:

Generic

The purpose of this IC and its associated EAL is to recognize a loss of DC power compromising the ability to monitor and control the removal of decay heat during cold shutdown or refueling operations.

Plants will routinely perform maintenance on a train related basis during shutdown periods. It is intended that the loss of the operating (operable) train is to be considered.

Site specific bus voltage should be based on the minimum bus voltage necessary for the operation of safety related equipment. This voltage value should incorporate a margin of at least 15 minutes of operation before the onset of inability to operate those loads. This voltage is usually near the minimum voltage selected when battery sizing is performed. Typically the value for the entire battery set is approximately 105 VDC. For a 60 cell string of batteries the cell voltage is typically 1.75 Volts per cell. For a 58 string battery set the minimum voltage is typically 1.81 Volts per cell.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Site Specific

The safety-related 125 VDC power distribution system is composed of the following [T.S. Bases 3.8.5 & UFSAR Section 8.3.2]:

- two 1700 amp-hour [BAT-2-1 & -2] and two 1140 amp-hour [BAT-2-3 & -4] 125 VDC batteries
- four 100 amp battery chargers
- four 125 VDC Switchboards [DC-SWBD2-1, -2, -3 & -4]

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU2 (continued)

- ten 125 VDC distribution panels (four each for [DC-SWBD2-1 & -2] and one each for [DC-SWBD2-3 & -4])

The system also supports a 120 VAC Vital Bus System (that powers vital plant instrumentation), which is powered from 125 VDC / 120 VAC inverters (or by rectified 480 VAC power being inverted, when AC power is available).

The 125 VDC and 120 VAC Vital Bus Systems are designed to provide redundant and reliable power to components and systems that are essential to plant safety, including the Reactor Protective System (RPS) and the Engineered Safety Feature Actuation System (ESFAS) (T.S. Bases 3.8.8).

The station batteries supply essential and nonessential 125 VDC loads and distribution panels during a loss of the battery charger supply. The batteries are sized to supply the station DC and AC vital bus loads for a period of 2 hours without AC power (UFSAR 8.3.2.1.3).

The 60 cell station batteries are rated at 1700 amp-hour capacity [BAT-2-1 & -2] or 1140 amp-hour capacity [BAT-2-3 & -4] to an end voltage of 1.84 volts per cell, i.e., 110.4 VDC battery voltage (UFSAR 8.3.2.1.3).

Basis Reference(s):

1. NEI 99-01 Rev 5, CU7
2. U2 UFSAR Section 8.3.2, DC Power Systems, Rev 19
3. U2 UFSAR Section 8.3.2.1.3, DC Power System Arrangement and Sizing, Rev 19
4. U2 UFSAR Section 8.3.2.2, DC Power Systems Analysis, Rev 19
5. BVPS-1&2 Technical Specification 3.8.5, DC Sources – Shutdown, Rev 0
6. BVPS-1&2 Technical Specification 3.8.8, Inverters – Shutdown, Rev 0

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU3

INITIATING CONDITION:

Inadvertent criticality.

Operating Mode Applicability:

5, 6

EALs:

1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.

Basis:

Generic

This IC addresses inadvertent criticality events that occur in cold shutdown or refueling modes such as fuel mis-loading events and inadvertent dilution events. This IC indicates a potential degradation of the level of safety of the plant, warranting an UNUSUAL EVENT EMERGENCY CLASSIFICATION LEVEL.

This condition can be identified using the startup rate monitor. The term "sustained" is used in order to allow exclusion of expected short term positive periods/startup rates from planned fuel bundle or control rod movements during core alteration. These short term positive startup rates are the result of the increase in neutron population due to subcritical multiplication.

Site Specific

This condition can be identified using:

- Source Range Detectors N-31 & N-32
- Intermediate Range Detectors N-35 & N-36
- Scaler Timer N-34 (Audible Count Rate)
- Gamma Metrics N-54A & 54B (refer to UFSAR 4.4.6.6.)

Basis Reference(s):

1. NEI 99-01 Rev 5, CU8
2. Regulatory Guide 8.12, Criticality Accident Alarm Systems

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU6

INITIATING CONDITION:

Loss of all ONSITE or OFFSITE communications capabilities.

Operating Mode Applicability:

5, 6, D

EALs:

1. Loss of **ALL** of the following ONSITE communication methods affecting the ability to perform routine operations:
   - Radios.
   - Plant page.
   - Plant telephone System (hardwired).

   OR

2. Loss of **ALL** of the following OFFSITE communications methods affecting the ability to perform OFFSITE notifications:
   - NRC Emergency Notification System – ENS.
   - NRC Health Physics Network – HPN.
   - Commercial telephones (hardwired and wireless).

Basis:

Generic

The purpose of this IC and its associated EALs is to recognize a loss of communications capability that either defeats the plant operations staff ability to perform routine tasks necessary for plant operations or the ability to communicate issues with OFFSITE authorities. The loss of OFFSITE communications ability is expected to be significantly more comprehensive than the condition addressed by 10 CFR 50.72.

The availability of one method of ordinary OFFSITE communications is sufficient to inform Federal, State, and local authorities of plant issues. This EAL is intended to be used only when extraordinary means (e.g., relaying of information from non-routine radio transmissions, individuals being sent to OFFSITE locations, etc.) are being used to make communications possible.

Site specific list for ONSITE communications loss must encompass the loss of all means of communications (e.g., commercial telephones, sound powered phone systems, plant page systems and radios).

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU6 (continued)

Site specific list for OFFSITE communications loss must encompass the loss of all means of communications with OFFSITE authorities. This should include the ENS, commercial telephone lines, telecopy transmissions, and dedicated phone systems.

Site Specific

None

Basis Reference(s):

1. NEI 99-01 Rev 5, CU6

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CG7

INITIATING CONDITION:

Loss of RCS inventory affecting fuel clad integrity with containment challenged.

Operating Mode Applicability:

5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. a. RCS level **< 56%** RVLIS Full Range (top of active fuel) for **30 minutes** or longer.

   AND

   b. **ANY Table C-1** containment challenge indications.

   OR

2. a. RCS level cannot be monitored with core uncovery for **30 minutes** or longer.

   AND

   b. Loss of RCS inventory as indicated by **ANY** of the following:

   - Containment Radiation Monitor (2RMR-RQ206 or 207) **> 15 R/hr**.
   - Erratic source range monitor indication.
   - UNPLANNED level rise in Containment sumps or incore instrument sump.

   AND

   c. **ANY Table C-1** containment challenge indications.

Table C-1: Containment Challenge Indications
• CONTAINMENT CLOSURE not established.
• Hydrogen concentration > 4% inside containment.
• UNPLANNED rise in containment pressure.

Basis:

Generic

This IC represents the inability to restore and maintain RPV level to above the top of active fuel with containment challenged. Fuel damage is probable if RPV level cannot be restored, as available decay heat will cause boiling, further reducing the RPV level. With the containment breached or challenged then the potential for unmonitored fission product release to the environment is high. This represents a direct path for radioactive inventory to be released to the environment. This is consistent with the definition of a GENERAL EMERGENCY. The GENERAL EMERGENCY is declared on the occurrence of the loss or IMMINENT loss of function of all three barriers.

These EALs are based on concerns raised by Generic Letter 88-17, "Loss of Decay Heat Removal," SECY 91-283, "Evaluation of Shutdown and Low Power Risk Issues," NUREG-1449, "Shutdown and Low-Power Operation at Commercial Nuclear Power Plants in the United States," and NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management."

A number of variables can have a significant impact on heat removal capability challenging the fuel clad barrier. Examples include: mid-loop, reduced level/flange level, head in place, cavity flooded, RCS venting strategy, decay heat removal system design, vortexing pre-disposition, and U-tube draining.

Analysis indicates that core damage may occur within an hour following continued core uncovery therefore, 30 minutes was conservatively chosen.

If CONTAINMENT CLOSURE is re-established prior to exceeding the 30 minute core uncovery time limit, then escalation to GENERAL EMERGENCY would not occur.

Site shutdown contingency plans typically provide for re-establishing CONTAINMENT CLOSURE following a loss of heat removal or RCS inventory functions.

In the early stages of a core uncovery event, it is unlikely that hydrogen buildup due to a core uncovery could result in an explosive mixture of dissolved gases in containment. However, containment monitoring and/or sampling should be performed to verify this assumption and a GENERAL EMERGENCY declared if it is determined that an explosive mixture exists.

EAL #2

Sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CG7 (continued)

In the cold shutdown mode, normal RCS level and RPV level instrumentation systems will usually be available. In the Refueling mode, normal means of RPV level indication may not be available. Redundant means of RPV level indication will usually be installed (including the ability to monitor level visually) to assure that the ability to monitor level will not be interrupted. However, if all level indication were to be lost during a loss of RCS inventory event, the operators would need to determine that RPV inventory loss was occurring by observing sump and tank level changes. Sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage.

As water level in the RPV lowers, the dose rate above the core will increase. The dose rate due to this core shine should result in site specific monitor indication and possible alarm.

This EAL should conservatively estimate a site specific dose rate setpoint indicative of core uncovery (i.e., level at TOAF).

For PWRs, post-TMI studies indicated that the installed nuclear instrumentation will operate erratically when the core is uncovered and that this should be used as a tool for making such determinations.

Site Specific

EAL #2.b bullet #1

Containment radiation is indicated on containment radiation monitors (CRMs) 2RMR-RQ206 and 207. These monitors are not located within line of sight of the reactor vessel. The containment radiation monitor alert alarm is set at 6.18E+2 R/hr and high alarm is set at 2.0E+4 R/hr. The alarm setpoints are considered operationally significant, but above what would be expected for a loss of vessel level while in the refuel mode. The CG7/CS7 CRM threshold values have been established at 15 R/Hr (~10x the low scale reading of 1.5 R/hr) to provide a reasonable and conservative indication of abnormal conditions associated with elevated radiation levels in containment due to a loss of water level with irradiated fuel in the vessel.

EAL #2.b bullet #2

Erratic Source Range Monitors indication can be identified using:

- Source Range Detectors N-31 & N-32
- Intermediate Range Detectors N-35 & N-36
- Scaler Timer N-34 (Audible Count Rate)
- Gamrna Metrics N-54A & 54B (refer to UFSAR 4.4.6.6.)

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CG7 (continued)

Table C-1

If hydrogen concentration reaches or exceeds 4% in an oxygen rich environment, a potentially combustible mixture exists.

Hydrogen monitors, although available at all times, are not in service during normal operations. They are started per 2OM-46.4.F.

The hydrogen monitor measurement range is 0 - 10 volume percent.

Basis Reference(s):

1. NEI 99-01 Rev 5, CG1
2. 2OM-5D.5.A.37, RVLIS Full Range Level vs. Reactor Vessel Height, Issue 4, Rev 0
3. 2OM-46.4.F, H2 Analyzer Startup, Rev 7

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CS7

INITIATING CONDITION:

Loss of RCS inventory affecting core decay heat removal capability.

Operating Mode Applicability:

5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. a. CONTAINMENT CLOSURE not established.

   AND

   b. RCS level **< 64%** RVLIS Full Range (6" below bottom of hot leg).

OR

2. a. CONTAINMENT CLOSURE established.

   AND

   b. RCS level **< 56%** RVLIS Full Range (top of active fuel).

OR

3. a. RCS level cannot be monitored for **30 minutes** or longer.

   AND

   b. Loss of RCS inventory as indicated by **ANY** of the following:

   - Containment Radiation Monitor (2RMR-RQ206 or 207) **> 15 R/hr**.
   - Erratic source range monitor indication.
   - UNPLANNED level rise in Containment sumps or incore instrument sump.

Basis:

Generic

Under the conditions specified by this IC, continued decrease in RCS/RPV level is indicative of a loss of inventory control. Inventory loss may be due to an RCS breach, pressure boundary leakage, or continued boiling in the RPV. Thus, declaration of a SITE AREA EMERGENCY is warranted.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CS7 (continued)

EAL #1

6" below the bottom ID of the RCS Loop should be the level equal to 6" below the bottom of the RPV loop penetration (not the low point of the loop). PWRs unable to measure this level should choose the first observable point below the bottom ID of the loop as the EAL value. If a water level instrument is not available such that the PWR EAL value cannot be determined, then EAL 3 should be used to determine if the IC has been met.

EAL #3

In the Cold Shutdown mode, normal RCS level and RPV level instrumentation systems will usually be available. In the Refueling mode, normal means of RPV level indication may not be available. Redundant means of RPV level indication will usually be installed (including the ability to monitor level visually) to assure that the ability to monitor level will not be interrupted. However, if all level indication were to be lost during a loss of RCS inventory event, the operators would need to determine that RPV inventory loss was occurring by observing sump and tank level changes. Sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage.

The 30-minute duration allows sufficient time for actions to be performed to recover inventory control equipment.

As water level in the RPV lowers, the dose rate above the core will increase. The dose rate due to this core shine should result in site specific monitor indication and possible alarm.

This EAL should conservatively estimate a site specific dose rate setpoint indicative of core uncovery (i.e., level at TOAF).

Post-TMI studies indicated that the installed nuclear instrumentation will operate erratically when the core is uncovered and that this should be used as a tool for making such determinations.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CS7 (continued)

Site Specific

EAL #3.b bullet #1

Containment radiation is indicated on containment radiation monitors (CRMs) 2RMR-RQ206 and 207. These monitors are not located within line of sight of the reactor vessel. The containment radiation monitor alert alarm is set at 6.18E+2 R/hr and high alarm is set at 2.0E+4 R/hr. The alarm setpoints are considered operationally significant, but above what would be expected for a loss of vessel level while in the refuel mode. The CG7/CS7 CRM threshold values have been established at 15 R/Hr (~10x the low scale reading of 1.5 R/hr) to provide a reasonable and conservative indication of abnormal conditions associated with elevated radiation levels in containment due to a loss of water level with irradiated fuel in the vessel.

EAL #3.b bullet #2

Erratic Source Range Monitors indication can be identified using:

- Source Range Detectors N-31 & N-32
- Intermediate Range Detectors N-35 & N-36
- Scaler Timer N-34 (Audible Count Rate)
- Gamma Metrics N-54A & 54B (refer to UFSAR 4.4.6.6.)

Basis Reference(s):

1. NEI 99-01 Rev 5, CS1
2. NEI 99-01 Rev 5, FAQ# 10
3. 2OM-5D.5.A.37, RVLIS Full Range Level vs. Reactor Vessel Height, Issue 4, Rev 0

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CA7

INITIATING CONDITION:

Loss of RCS inventory.

Operating Mode Applicability:

5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. Loss of RCS inventory as indicated by **EITHER** of the following:
   - RVLIS Full Range Level (2RCS-LT1321) **< 65%** (bottom of hot leg).
   - Refueling Outage Temporary Level Instrument (2RCS-LI102) **≤ 6 inches.**

   OR

2. a. RCS level cannot be monitored for **15 minutes** or longer.

   AND

   b. Loss of RCS inventory as indicated by UNPLANNED level rise in Containment sumps or incore instrument sump.

Basis:

Generic

These EALs serve as precursors to a loss of ability to adequately cool the fuel. The magnitude of this loss of water indicates that makeup systems have not been effective and may not be capable of preventing further RPV level decrease and potential core uncovery. This condition will result in a minimum EMERGENCY CLASSIFICATION LEVEL of an ALERT.

EAL #1

The PWR Bottom ID of the RCS Loop setpoint was chosen because at this level remote RCS level indication may be lost and loss of suction to decay heat removal systems has occurred. The Bottom ID of the RCS Loop Setpoint should be the level equal to the bottom of the RPV loop penetration (not the low point of the loop).

The inability to restore and maintain level after reaching this setpoint would be indicative of a failure of the RCS barrier.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CA7 (continued)

EAL #2

In the Cold Shutdown mode, normal RCS level and RPV level instrumentation systems will usually be available. In the Refueling mode, normal means of RPV level indication may not be available. Redundant means of RPV level indication will usually be installed (including the ability to monitor level visually) to assure that the ability to monitor level will not be interrupted. However, if all level indication were to be lost during a loss of RCS inventory event, the operators would need to determine that RPV inventory loss was occurring by observing sump and tank level changes. Sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage.

The 15-minute duration for the loss of level indication was chosen because it is half of the CS7 duration. Significant fuel damage is not expected to occur until the core has been uncovered for greater than 1 hour per the analysis referenced in the CG7 basis. Therefore this EAL meets the definition for an ALERT.

Site Specific

EAL #1

RVLIS (2RCS-LT1321) readings may be affected by RCS Loop Stop valve closure.

Refueling Outage Temporary Level Instrument 2RCS-LI102 (typically available in Mode 6) cannot measure RCS level below 731 feet 2 inches elevation (reactor pressure vessel hot leg nozzle bottom elevations) which corresponds to the lowest increment of 0 inches on the instrument. The EAL value has been established at 6 inches as the lowest distinguishable reading for the instrument.

Basis Reference(s):

1. NEI 99-01 Rev 5, CA1
2. NEI 99-01 Rev 5, FAQ# 10
3. 2OM-5D.5.A.37, RVLIS Full Range Level vs. Reactor Vessel Height, Issue 4, Rev 0
4. 2OM-6.1.E, Specific Instrumentation and Control, Rev 6
5. 2LCP-6-L102, 2RCS-L102, Reactor Vessel Refueling Level Loop Calibration (see pages 28 & 33), Issue 4, Rev 3

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU7

INITIATING CONDITION:

RCS leakage.

Operating Mode Applicability:

5

EALs:

Note:

- The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.
- Relief valve normal operation should be excluded unless it fails to close and cannot be isolated.

1. RCS leakage results in the inability to maintain or restore RCS level **> Target Level Band** for **15 minutes** or longer.

Basis:

Generic

This IC is considered to be a potential degradation of the level of safety of the plant. The inability to maintain or restore level is indicative of loss of RCS inventory.

Relief valve normal operation should be excluded from this IC. However, a relief valve that operates and fails to close per design should be considered applicable to this IC if the relief valve cannot be isolated.

The difference between CU7 and CU8 deals with the RCS conditions that exist between cold shutdown and refueling modes. In the refueling mode the RCS is not intact and RPV level and inventory are monitored by different means. In cold shutdown the RCS will normally be intact and standard RCS inventory and level monitoring means are available.

Site Specific

Normally, the RCS level band is established by 2OM-52.4.R.F. On loss of coolant in Mode 5, 2OM-53C.4.2.10.1 is used.

Isolating letdown is a standard abnormal operating procedure action and may prevent unnecessary classifications when a non-RCS leakage path such as a CVCS leak exists.

Added generic basis Note for relief valve operation.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU7 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, CU1
2. 2OM-52.4.R.F.2, Refueling Station Shutdown - Mode 5 Activities, Rev 13
3. 2OM-53C.4.2.10.1, Loss of Residual Heat Removal Capability, Rev 11

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU8

INITIATING CONDITION:

UNPLANNED loss of RCS inventory.

Operating Mode Applicability:

6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. UNPLANNED RCS level drop as indicated by **EITHER** of the following:

   - Refueling Outage Temporary Level Instrument (2RCS-LI102) **< 96 inches** (vessel flange) for **15 minutes** or longer when the RCS level band is established **above** the vessel flange.

     OR

   - RCS water level drop below the RCS level band for **15 minutes** or longer when the RCS level band is established **below** the vessel flange.

   OR

2. a. RCS level cannot be monitored.

   AND

   b. Loss of RCS inventory as indicated by UNPLANNED level rise in containment sumps or incore instrument sump.

Basis:

Generic

This IC is a precursor of more serious conditions and considered to be a potential degradation of the level of safety of the plant.

Refueling evolutions that decrease RCS water level below the RPV flange are carefully planned and procedurally controlled. An UNPLANNED event that results in water level decreasing below the RPV flange, or below the planned RCS water level for the given evolution (if the planned RCS water level is already below the RPV flange), warrants declaration of an UNUSUAL EVENT due to the reduced RCS inventory that is available to keep the core covered.

The allowance of 15 minutes was chosen because it is reasonable to assume that level can be restored within this time frame using one or more of the redundant means of refill that should be available. If level cannot be restored in this time frame then it may indicate a more serious condition exists.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU8 (continued)

The difference between CU7 and CU8 deals with the RCS conditions that exist between cold shutdown and refueling modes. In cold shutdown the RCS will normally be intact and standard RCS inventory and level monitoring means are available. In the refueling mode the RCS is not intact and RPV level and inventory are monitored by different means.

EAL #1

This EAL involves a decrease in RCS level below the top of the RPV flange that continues for 15 minutes due to an UNPLANNED event. This EAL is not applicable to decreases in flooded reactor cavity level, which is addressed by RU2.1 until such time as the level decreases to the level of the vessel flange.

EAL #2

This EAL addresses conditions in the refueling mode when normal means of core temperature indication and RCS level indication may not be available. Redundant means of RCS level indication will normally be installed (including the ability to monitor level visually) to assure that the ability to monitor level will not be interrupted. However, if all level indication were to be lost during a loss of RCS inventory event, the operators would need to determine that RCS inventory loss was occurring by observing sump and tank level changes. Sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage.

Site Specific

EAL #1

The Reactor Vessel flange is at 739 feet 2 3/8 inches (96 inches indicated). RCS level is normally monitored using the following instrument:

- 2RCS-LI102

Reactor vessel level indication (2RCS-LI102) provide accurate indication of water level when the RCS is at atmospheric pressure and above the bottom of the hot leg nozzle elevation.

CU8 (continued)

Basis Reference(s):

1. NEI 99-01 Rev 5, CU2
2. NEI 99-01 Rev 5, FAQ# 10
3. 2OM-6.5.A.65, Figure 6-65 RCS Level Scale, Issue 4, Rev 0
4. 2LCP-6-L102, 2RCS-L102 Reactor Vessel Refueling Level Loop Calibration (see pages 28 & 33), Issue 4, Rev 3
5. 2OM-6.4.I, Draining the RCS for Refueling (see p. 24 of 42), Rev 24

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CA10

INITIATING CONDITION:

Inability to maintain plant in cold shutdown.

Operating Mode Applicability:

5, 6

EALs:

Note: Full inventory is pressurizer level ≥ 22% actual with loop stops either isolated or unisolated.

1. RCS temperature **> 200° F** due to an UNPLANNED loss of decay heat removal capability for greater than the specified duration on **Table C-2**.

Table C-2: RCS Reheat Duration Thresholds		
RCS	**CONTAINMENT CLOSURE**	**Duration**
Intact with Full RCS Inventory	N/A	> 60 minutes**
Not Intact OR Not Full RCS Inventory	Established	> 20 minutes**
	Not Established	0 minutes

** If an RCS heat removal system is in operation within this time frame and RCS temperature is being reduced, then this EAL is not applicable.

OR

2. a. RCS temperature cannot be monitored.

   AND

   b. RCS pressure rise **> 10 psi** due to an UNPLANNED loss of decay heat removal capability (this EAL does not apply in RCS solid plant conditions).

Basis:

Generic

For PWRs, this IC and its associated EALs are based on concerns raised by Generic Letter 88-17, "Loss of Decay Heat Removal." A number of phenomena such as pressurization, vortexing, RCS level differences when operating at a mid-loop condition, decay heat removal system design, and level instrumentation problems can lead to conditions where decay heat removal is lost and core uncovery can occur. NRC analyses show that there are sequences that can cause core uncovery in 15 to 20 minutes and severe core damage within an hour after decay heat removal is lost.

A loss of Technical Specification components alone is not intended to constitute an ALERT. The same is true of a momentary UNPLANNED excursion above the Technical Specification cold shutdown temperature limit when the heat removal function is available.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CA10 (continued)

EAL #1

The RCS Reheat Duration Threshold table addresses complete loss of functions required for core cooling for greater than 60 minutes during refueling and cold shutdown modes when RCS integrity is established. RCS should be considered intact when the RCS pressure boundary is established (e.g., no freeze seals, nozzle dams installed or SG manways removed). The status of CONTAINMENT CLOSURE in this condition is immaterial given that the RCS is providing a high pressure barrier to fission product release to the environment. The 60 minute time frame should allow sufficient time to restore cooling without there being a substantial degradation in plant safety.

The RCS Reheat Duration Threshold table also addresses the complete loss of functions required for core cooling for greater than 20 minutes during refueling and cold shutdown modes when CONTAINMENT CLOSURE is established but RCS is not intact. As discussed above, RCS should be assumed to be intact when the RCS pressure boundary is established (e.g., no freeze seals, nozzle dams installed or SG manways removed). The allowed 20 minute time frame was included to allow operator action to restore the heat removal function, if possible. The allowed time frame is consistent with the guidance provided by Generic Letter 88-17, "Loss of Decay Heat Removal," (discussed earlier in this basis) and is believed to be conservative given that a low pressure Containment Barrier to fission product release is established.

Finally, the RCS Reheat Duration Threshold table also addresses the complete loss of functions required for core cooling during refueling and cold shutdown modes when neither CONTAINMENT CLOSURE is established nor RCS is intact. RCS is intact when the RCS pressure boundary is in its normal condition for the cold shutdown mode of operation (e.g., no freeze seals or nozzle dams). No delay time is allowed because the evaporated reactor coolant that may be released into the containment during this heatup condition could also be directly released to the environment.

The note (**) indicates that this EAL is not applicable if actions are successful in restoring an RCS heat removal system to operation and RCS temperature is being reduced within the specified time frame.

EAL #2

The 10 psi pressure increase addresses situations where, due to high decay heat loads, the time provided to restore temperature control, should be less than 60 minutes. The RCS pressure setpoint chosen should be 10 psi or the lowest pressure that the site can read on installed Control Board instrumentation that is equal to or greater than 10 psi.

Site Specific

Time to RCS Boiling for various RCS configurations and fluid levels (as a function of time since reactor shutdown) can be found in the Abnormal Operating Procedures (AOPs) 2OM-53C.4.2.10.1 & 2. With RCS loop isolation valves installed at BVPS-2, the shortest RCS time to boiling during a typical scheduled refueling outage is more than 15 minutes.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CA10 (continued)

EAL #1

The following instrumentation is capable of providing indication of an RCS temperature rise that approaches the Technical Specification Cold Shutdown temperature limit of (200° F):

- CETs (Incore Thermocouples)
- RCS Wide Range Hot Leg Instruments
- RCS Wide Range Cold Leg Instruments
- RHR System Inlet Temperature

EAL #2

The following instrumentation is capable of providing indication of a 10 psi increase in RCS pressure:

- RCS Wide Range Pressure Instruments

Basis Reference(s):

1. NEI 99-01 Rev 5, CA4
2. NEI 99-01 Rev 5, FAQ# 13
3. NOP-OP-1005, Shutdown Defense in Depth, Rev 13
4. 2OM-53C.4.2.10.1, Loss of Residual Heat Removal Capability, Rev 11
5. 2OM-53C.4.2.10.2, Loss of RHR While Operating At Reduced Inventory / Midloop Conditions, Rev 8

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU10

INITIATING CONDITION:

UNPLANNED Loss of decay heat removal capability.

Operating Mode Applicability:

5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. RCS temperature **> 200° F** due to an UNPLANNED loss of decay heat removal capability.

   OR

2. Loss of **ALL** RCS temperature and RCS level indication for **15 minutes** or longer.

Basis:

Generic

This IC is a precursor of more serious conditions and, as a result, is considered to be a potential degradation of the level of safety of the plant. In cold shutdown the ability to remove decay heat relies primarily on forced cooling flow. Operation of the systems that provide this forced cooling may be jeopardized due to the unlikely loss of electrical power or RCS inventory. Since the RCS usually remains intact in the cold shutdown mode a large inventory of water is available to keep the core covered.

Entry into cold shutdown conditions may be attained within hours of operating at power. Entry into the refueling mode procedurally may not occur for typically 100 hours (site specific) or longer after the reactor has been shutdown. Thus the heatup threat and therefore the threat to damaging the fuel clad may be lower for events that occur in the Refueling mode with irradiated fuel in the RPV (note that the heatup threat could be lower for cold shutdown conditions if the entry into cold shutdown was following a refueling). In addition, the operators should be able to monitor RCS temperature and RPV level so that escalation to the ALERT level will occur if required.

During refueling the level in the RPV will normally be maintained above the RPV flange. refueling evolutions that decrease water level below the RPV flange are carefully planned and procedurally controlled. Loss of forced decay heat removal at reduced inventory may result in more rapid increases in RCS temperatures depending on the time since shutdown.

RECOGNITION CATEGORY
SYSTEM MALFUNCTIONS - COLD

CU10 (continued)

Unlike the cold shutdown mode, normal means of core temperature indication and RCS level indication may not be available in the refueling mode. Redundant means of RPV level indication are therefore procedurally installed to assure that the ability to monitor level will not be interrupted. However, if all level and temperature indication were to be lost in either the cold shutdown of refueling modes, EAL #2 would result in declaration of an UNUSUAL EVENT if both temperature and level indication cannot be restored within 15 minutes from the loss of both means of indication.

Site Specific

Time to RCS Boiling for various RCS configurations and fluid levels (as a function of time since reactor shutdown) can be found in the Abnormal Operating Procedures (AOPs) 2OM-53C.4.2.10.1 & 2. With RCS loop isolation valves installed at BVPS-2, the shortest RCS time to boiling during a typical scheduled refueling outage is more than 15 minutes.

EAL #1

The following instrumentation is capable of providing indication of an RCS temperature rise that approaches the Technical Specification Cold Shutdown temperature limit of (200° F):

- CET's (incore Thermocouples)
- RCS Wide Range Hot Leg Instruments
- RCS Wide Range Cold Leg Instruments
- RHR System Inlet Temperature

Basis Reference(s):

1. NEI 99-01 Rev 5, CU4
2. NEI 99-01 Rev 5, FAQ# 11
3. NOP-OP-1005, Shutdown Defense in Depth, Rev 13
4. 2OM-53C.4.2.10.1, Loss of Residual Heat Removal Capability, Rev 11
5. 2OM-53C.4.2.10.2, Loss of RHR While Operating At Reduced Inventory / Midloop Conditions, Rev 8

Appendix 3
L-11-320

Proposed Beaver Valley Power Station, Unit Nos. 1 and 2
Emergency Preparedness Plan Revision to Appendix G, “References”
(Sixteen pages follow)

APPENDIX G

REFERENCES

APPENDIX G

REFERENCE

C1	-	CR# 980708
C2	-	CR# 980706
C3	-	CR#980480
C4	-	NPDAP 5.1 "Report Requirements"
C5	-	Unit 2 Licensing Condition 2.C(6)
C6	-	CR#992882
C7	-	CR#990012
C8	-	CR#00-0616
C9	-	CR#00-0617
C10	-	CR#00-0618
C11	-	CR#00-0615
C12	-	CR#01-0246
C13	-	CR#01-1168
C14	-	CR#00-3939
C15	-	CR#00-2202
C16	-	CR#01-0246
C17	-	CR#99-1234
C18	-	CR#01-1011

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REFERENCE

C19	-	CR#01-3556
C20	-	LAR #295 and #166 (Letter Number L-01-103, 8/13/01, PASS Elimination, CR# 01-2107)
C21	-	CR#02-02195 and NRC Inspection Report 50-334/02-03, 50-412/02-03, dated 4/12/02
C22	-	CR#02-02524
C23	-	CA's # 01-6025-6, 01-3198-98, 02-00444-5
C24	-	CA #02-00444-4
C25	-	CA's #02-0667-01, 02-07647-06
C26	-	CR's #02-08649, 02-09224
C27	-	CR#02-09061-01
C28	-	CR#03-01371
C29	-	CA# 02-02195-8
C30	-	CR#04-00104
C31	-	CA#03-02202-15 (Includes deletion of Section 7, Figures and Tables
C32	-	CA#03-09983-1
C33	-	CA#04-01302-1
C34	-	CA#03-12278-01
C35	-	CA#04-02011-14
C36	-	CA#03-02202-15

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REFERENCE

C37	-	CA#03-06133-1
C38	-	CA#03-06133-2
C39	-	CA#03-06133-3
C40	-	CA#03-06133-6
C41	-	CA#03-12097-1
C42	-	CA#03-16133-4
C43	-	CA#04-05163
C44	-	CR#05-03243-04
C45	-	CR#05-01489-01
C46	-	Reference: NRC Bulletin 2005-02
C47	-	CR#05-0651
C48	-	CR#04-06540
C49	-	CA#07-31052-02
C50	-	Reference: Eplan Section 6 PAF 11-01349 and 1/2-EPP-IP-2.6.1 PAF 10-02713
Cxx	-	CA# 10-78117-01, involves Unit 1/2 EAL upgrade to NEI 99-01, Rev 5 and NEI 03-12

The Emergency Preparedness Plan/NUREG-0654 Cross Reference was developed using the following documents:

NUREG-0654, Rev. 1	November 1980
EPP Section 1	Rev. 10
EPP Section 2	Rev. 10
EPP Section 3	Rev. 10
EPP Section 4	Rev. 11
EPP Section 5	Rev. 10
EPP Section 6	Rev. 10
EPP Section 7	Rev. 10
EPP Section 8	Rev. 10 Unless Otherwise Noted
EPP Section 9	Rev. 10
EPP Appendix A	Rev. 10
EPP Appendix B	Rev. 10
EPP Appendix C	Rev. 10
EPP Appendix D	Rev. 10
EPP Appendix E	Rev. 10
EPP Appendix F	Rev. 10

NUREG-0654 CROSS REFERENCE

Reference	Emergency Plan Reference
NUREG-0654, Section II.A.1.a	Paragraph 5.5 Paragraph 5.6.1 Paragraph 5.6.2
NUREG-0654, Section II.A.1.b	Paragraph 5.2 Paragraph 5.3 Paragraph 5.4
NUREG-0654, Section II.A.1.c	Figures 5.1 through 5.5 Section 5.6
NUREG-0654, Section II.A.1.d	Paragraph 5.2.1 Paragraph 5.2.2
NUREG-0654, Section II.A.1.e	Paragraph 5.2 Tables 6.1 and 6.2
NUREG-0654, Section II.A.3	Paragraph 8.3.d Appendix A
NUREG-0654, Section II.A.4	Paragraph 5.2.1 Paragraph 5.2.2
NUREG-0654, Section II.B.1	Figure 5.2
NUREG-0654, Section II.B.2	Paragraph 5.2.1 Paragraph 5.2.2 Appendix E
NUREG-0654, Section II.B.3	Paragraph 5.2.1 Paragraph 5.2.3
NUREG-0654, Section II.B.4	Paragraph 5.2.1
NUREG-0654, Section II.B.5	Paragraph 5.2 Table 5.1
NUREG-0654, Section II.B.6	Paragraph 5.5 Figure 5.6
NUREG-0654, Section II.B.7	Paragraph 5.2 Table 5.1
NUREG-0654, Section II.B.7.a	Paragraph 5.2.18
NUREG-0654, Section II.B.7.b	Paragraph 9.3 Paragraph 9.4

NUREG-0654 CROSS REFERENCE

Reference	Emergency Plan Reference
NUREG-0654, Section II.B.7.c	Paragraph 5.2.19 Paragraph 5.2.2
NUREG-0654, Section II.B.7.d	Paragraph 5.3
NUREG-0654, Section II.B.8	Paragraph 5.5.2 Paragraph 5.5.3 Paragraph 5.5.4
NUREG-0654, Section II.B.9	Paragraph 5.5.5 Appendix A
NUREG-0654, Section II.C.1.a	Paragraph 5.2.1.7 Paragraph 5.2.2.6
NUREG-0654, Section II.C.1.b	Paragraph 5.6.2
NUREG-0654, Section II.C.1.c	Paragraph 7.1.4 Paragraph 7.6
NUREG-0654, Section II.C.2.b	Paragraph 5.6.1
NUREG-0654, Section II.C.3	Paragraph 7.1.4 Paragraph 7.4
NUREG-0654, Section II.C.4	Paragraph 5.5 Paragraph 5.6 Appendix A
NUREG-0654, Section II.D.1	Section 4
NUREG-0654, Section II.D.2	Section 4
NUREG-0654, Section II.E.1	Paragraph 6.4
NUREG-0654, Section II.E.2	Paragraph 7.6
NUREG-0654, Section II.E.3	Paragraph 6.4.1
NUREG-0654, Section II.E.4	Paragraph 6.4.2

NUREG-0654 CROSS REFERENCE

Reference	Emergency Plan Reference
NUREG-0654, Section II.E.4.a	Paragraph 6.4.2
NUREG-0654, Section II.E.4.b	Paragraph 6.4.2
NUREG-0654, Section II.E.4.c	Paragraph 6.4.2
NUREG-0654, Section II.E.4.d	Paragraph 6.4.2
NUREG-0654, Section II.E.4.e	Paragraph 6.4.2
NUREG-0654, Section II.E.4.f	Paragraph 6.4.2
NUREG-0654, Section II.E.4.g	Paragraph 6.4.2
NUREG-0654, Section II.E.4.h	Paragraph 6.4.2
NUREG-0654, Section II.E.4.i	Paragraph 6.4.2
NUREG-0654, Section II.E.4.j	Paragraph 6.4.2
NUREG-0654, Section II.E.4.k	Paragraph 6.4.2
NUREG-0654, Section II.E.4.l	Paragraph 6.4.2
NUREG-0654, Section II.E.4.m	Paragraph 6.4.2
NUREG-0654, Section II.E.4.n	Paragraph 6.4.2
NUREG-0654, Section II.E.6	Paragraph 3.3.3 Appendix F
NUREG-0654, Section II.E.7	Paragraph 6.7.2.5
NUREG-0654, Section II.F.1.a	Paragraph 7.6 Table 6.2

NUREG-0654 CROSS REFERENCE

Reference	Emergency Plan Reference
NUREG-0654, Section II.F.1.b	Paragraph 7.6 Table 6.2
NUREG-0654, Section II.F.1.c	Paragraph 7.6 Table 7.1
NUREG-0654, Section II.F.1.d	Paragraph 7.6 Table 7.1
NUREG-0654, Section II.F.1.e	Paragraph 7.6 Table 7.1
NUREG-0654, Section II.F.1.f	Paragraph 7.6.3
NUREG-0654, Section II.F.2	Paragraph 7.6.1 Paragraph 7.6.2 Paragraph 7.6.5 Paragraph 6.3.1
NUREG-0654, Section II.F.3	Paragraph 8.1.4.f Paragraph 7.6
NUREG-0654, Section II.G.1	Paragraph 8.1.1.a
NUREG-0654, Section II.G.1.a, b, c, d	Paragraph 8.5
NUREG-0654, Section II.G.2	Paragraph 8.5
NUREG-0654, Section II.G.3.a	Paragraph 7.1.5
NUREG-0654, Section II.G.3.b	Paragraph 7.1.5
NUREG-0654, Section II.G.4.a	Paragraph 5.3.1
NUREG-0654, Section II.G.4.b	Paragraph 5.3.1 Paragraph 5.3.2
NUREG-0654, Section II.G.4.c	Paragraph 5.3.4.1
NUREG-0654, Section II.G.5	Paragraph 8.1.2.f

NUREG-0654 CROSS REFERENCE

Reference	Emergency Plan Reference
NUREG-0654, Section II.H .1	Paragraph 7.1.4.1 Paragraph 7.1.2
NUREG-0654, Section II.H.2	Paragraph 7.1.4.2
NUREG-0654, Section II.H.4	Paragraph 6.2
NUREG-0654, Section II.H.5	Paragraph 7.4
NUREG-0654, Section II.H.5.a	Paragraph 7.4.3
NUREG-0654, Section II.H.5.b	Paragraph 7.4.1
NUREG-0654, Section II.H.5.c	Paragraph 7.4.4
NUREG-0654, Section II.H.5.d	Paragraph 7.4.2
NUREG-0654, Section II.H.6.a	Paragraph 7.4.3
NUREG-0654, Section II.H.6.b	Paragraph 7.4.1 Appendix D
NUREG-0654, Section II.H.6.c	Paragraph 7.1.4.3 Paragraph 7.1.4.4 Paragraph 7.4.1.3
NUREG-0654, Section II.H.7	Paragraph 7.2 Appendix D
NUREG-0654, Section II.H.8	Paragraph 7.4.3.1
NUREG-0654, Section II.H.9	Paragraph 7.1.2
NUREG-0654, Section II.H.10	Paragraph 8.4
NUREG-0654, Section II.H.11	Appendix D

NUREG-0654 CROSS REFERENCE

Reference	Emergency Plan Reference
NUREG-0654, Section II.H.12	Paragraph 5.2.8 Paragraph 7.1.4.4
NUREG-0654, Section II.I.1	Section 4
NUREG-0654, Section II.I.2	Paragraph 7.4.1 Paragraph 7.4.1.6
NUREG-0654, Section II.I.3.a	Paragraph 6.5.3
NUREG-0654, Section II.I.3.b	Paragraph 6.5.3
NUREG-0654, Section II.I.4	Paragraph 6.5.3 Paragraph 6.5.4
NUREG-0654, Section II.I.5	Paragraph 7.4.3.1 Paragraph 7.1.4.e Paragraph 7.6.3
NUREG-0654, Section II.I.6	Paragraph 6.5.3.2
NUREG-0654, Section II.I.7	Paragraph 6.5.4
NUREG-0654, Section II.I.8	Paragraph 6.5.4 Table 5.1 Table 6.1
NUREG-0654, Section II.I.9	Paragraph 6.5.4.3
NUREG-0654, Section II.I.10	Paragraph 6.5.3.2
NUREG-0654, Section II.J.1	Paragraph 6.7.1
NUREG-0654, Section II.J.1.a	Paragraph 6.7.1
NUREG-0654, Section II.J.1.b	Paragraph 6.7.1
NUREG-0654, Section II.J.1.c	Paragraph 6.7.1

NUREG-0654 CROSS REFERENCE

Reference	Emergency Plan Reference
NUREG-0654, Section II.J.1.d	Paragraph 6.7.1
NUREG-0654, Section II.J.2	Paragraph 6.7.1 Paragraph 7.5.3 Figure 7.2
NUREG-0654, Section II.J.3	Paragraph 6.7.1.6
NUREG-0654, Section II.J.4	Paragraph 6.7.1.4 Paragraph 6.7.1.6
NUREG-0654, Section II.J.5	Paragraph 5.2.13.3 Paragraph 5.2.6.4 Paragraph 6.7.1.5
NUREG-0654, Section II.J.6.a	Paragraph 6.7.1.8
NUREG-0654, Section II.J.6.b	Paragraph 6.7.1.6
NUREG-0654, Section II.J.6.c	Paragraph 6.7.1.8
NUREG-0654, Section II.J.7	Paragraph 6.7.2
NUREG-0654, Section II.J.8	Appendix B
NUREG-0654, Section II.J.10.a	Figure 7.2 (Evacuation Route) Paragraph 7.5.3
NUREG-0654, Section II.J.10.b	Appendix B, Figure B-1
NUREG-0654, Section II.J.10.c	Appendix F
NUREG-0654, Section II.J.10.m	Appendix B Paragraph 6.7.1.2
NUREG-0654, Section II.K.1	Table 6.3

NUREG-0654 CROSS REFERENCE

Reference	Emergency Plan Reference
NUREG-0654, Section II.K.1.a	Table 6.3
NUREG-0654, Section II.K.1.b	Table 6.3
NUREG-0654, Section II.K.1.c	Table 6.3
NUREG-0654, Section II.K.1.d	Table 6.3
NUREG-0654, Section II.K.1.e	Table 6.3
NUREG-0654, Section II.K.1.f	Table 6.3
NUREG-0654, Section II.K.1.g	Table 6.3
NUREG-0654, Section II.K.2	Paragraph 5.2.1 Paragraph 6.7.1.7
NUREG-0654, Section II.K.3.a	Table 5.1 Paragraph 6.7.1.7
NUREG-0654, Section II.K.3.b	Paragraph 6.7.1.7
NUREG-0654, Section II.K.5.a	Paragraph 6.8.1
NUREG-0654, Section II.K.5.b	Paragraph 6.8.1 Paragraph 6.8.2
NUREG-0654, Section II.K.6.a	Paragraph 6.7.1.6
NUREG-0654, Section II.K.6.b	Paragraph 6.7.1.6
NUREG-0654, Section II.K.6.c	Paragraph 6.7.1.6
NUREG-0654, Section II.K.7	Paragraph 6.7.1.6

NUREG-0654 CROSS REFERENCE

Reference	Emergency Plan Reference
NUREG-0654, Section II.L.1	Appendix A Paragraph 6.8.4
NUREG-0654, Section II.L.2	Paragraph 6.8.2
NUREG-0654, Section II.L.4	Appendix A Paragraph 6.8.3
NUREG-0654, Section II.M.1	Section 9
NUREG-0654, Section II.M.2	Section 9
NUREG-0654, Section II.M.3	Paragraph 9.2
NUREG-0654, Section II.M.4	Paragraph 9.6
NUREG-0654, Section II.N.1.a	Paragraph 8.1.4.a
NUREG-0654, Section II.N.1.b	Paragraph 8.1.4.a
NUREG-0654, Section II.N.2.a	Paragraph 8.1.4(f)
NUREG-0654, Section II.N.2.b	Paragraph 8.1.4(b)
NUREG-0654, Section II.N.2.c	Paragraph 8.1.4(c)
NUREG-0654, Section II.N.2.d	Paragraph 8.1.4(d)
NUREG-0654, Section II.N.2.e	Paragraph 8.1.4(e)
NUREG-0654, Section II.N.3	Paragraph 8.1.3.d
NUREG-0654, Section II.N.3.a	Paragraph 8.1.3.d

NUREG-0654 CROSS REFERENCE

Reference	Emergency Plan Reference
NUREG-0654, Section II.N.3.b	Paragraph 8.1.3.d
NUREG-0654, Section II.N.3.c	Paragraph 8.1.3.d
NUREG-0654, Section II.N.3.d	Paragraph 8.1.3.d
NUREG-0654, Section II.N.3.e	Paragraph 8.1.3.d
NUREG-0654, Section II.N.3.f	Paragraph 8.1.3.d
NUREG-0654, Section II.N.4	Paragraph 8.1.3.f
NUREG-0654, Section II.N.5	Paragraph 8.1.3.g
NUREG-0654, Section II.O.1.a	Paragraph 8.1.2.b
NUREG-0654, Section II.O.2	Paragraph 8.1.2
NUREG-0654, Section II.O.3	Paragraph 6.8.2
NUREG-0654, Section II.O.4.a	Paragraph 8.1.1.b
NUREG-0654, Section II.O.4.b	Paragraph 8.1.1.b
NUREG-0654, Section II.O.4.c	Paragraph 8.1.1.b
NUREG-0654, Section II.O.4.d	Paragraph 8.1.1.c Paragraph 8.1.2.c Paragraph 8.1.2e
NUREG-0654, Section II.O.4.e	Paragraph 8.1.2.a
NUREG-0654, Section II.O.4.f	Paragraph 8.1.1.b

NUREG-0654 CROSS REFERENCE

Reference	Emergency Plan Reference
NUREG-0654, Section II.O.4.g	Paragraph 8.1.2.b
NUREG-0654, Section II.O.4.h	Paragraph 8.1.2.d
NUREG-0654, Section II.O.4.i	Paragraph 8.1.1.b
NUREG-0654, Section II.O.4.j	Paragraph 8.1.1.b
NUREG-0654, Section II.O.5	Paragraph 8.1.1 (Rev. 11)
NUREG-0654, Section II.P.1	Paragraph 8.2
NUREG-0654, Section II.P.2	Paragraph 8.2
NUREG-0654, Section II.P.3	Paragraph 8.2
NUREG-0654, Section II.P.4	Paragraph 8.3.d
NUREG-0654, Section II.P.5	Paragraph 8.3.b
NUREG-0654, Section II.P.6	Paragraph 5.6
NUREG-0654, Section II.P.7	Appendix C
NUREG-0654, Section II.P.8	Table of Contents in front of Plan and for each Section.
NUREG-0654, Section II.P.9	Paragraph 8.3.e Paragraph 8.3.f
NUREG-0654, Section II.P.10	Paragraph 8.3.g Paragraph 8.1.4.f

Appendix 4
L-11-320

Beaver Valley Power Station Unit No. 1 EAL Evaluation
(Forty-Eight pages follow)

BACKGROUND AND SCOPE

The Emergency Action Level (EAL) scheme for the Beaver Valley Power Station Unit No. 1 (BVPS-1) is currently written to conform to the guidance provided in NUMARC/NESP-007, "Methodology for Development of Emergency Action Levels."

Nuclear Energy Institute (NEI) 99-01, "Methodology for Development of Emergency Action Levels," Revision 5 (ADAMS Accession No. ML080450149) was accepted for use by the NRC in a letter to NEI dated February 22, 2008. NEI submitted a series of frequently asked questions (FAQs), which clarified portions of NEI 99-01, Revision 5, to the NRC for review. By NRC memorandum dated September 17, 2010 (ADAMS Accession Nos. ML102580901 and ML102030330), the NRC stated that they performed a technical review of the FAQs and accepted the disposition of a number of the FAQs.

This revision to the Beaver Valley Power Station Unit No. 1 Emergency Plan EALs will provide a site specific version of the NEI 99-01, Revision 5 EALs, as clarified by a series of frequently asked questions associated with the NEI methodology. This analysis documents conformance of the Beaver Valley Power Station Unit No. 1 EALs to the NEI 99-01, Revision 5 EAL developmental guidance.

PROGRAM REQUIREMENTS

10 CFR 50.47(b)(4)

A standard emergency classification and action level scheme, the bases of which include facility system and effluent parameters, is in use by the nuclear facility licensee, and State and local response plans call for reliance on information provided by facility licensees for determinations of minimum initial offsite response measures.

10 CFR 50 Appendix E Section IV.B

The means to be used for determining the magnitude of and for continually assessing the impact of the release of radioactive materials shall be described, including emergency action levels that are to be used as criteria for determining the need for notification and participation of local and State agencies, the Commission, and other Federal agencies, and the emergency action levels that are to be used for determining when and what type of protective measures should be considered within and outside the site boundary to protect health and safety. The emergency action levels shall be based on in-plant conditions and instrumentation in addition to onsite and offsite monitoring. These initial emergency action levels shall be discussed and agreed on by the applicant or licensee and State and local governmental authorities, and approved by NRC. Thereafter, emergency action levels shall also be reviewed with the State and local governmental authorities on an annual basis.

Regulatory Guide 1.101

The NRC has stated, in a letter to the Nuclear Energy Institute, that it will pursue endorsement of NEI 99-01, Revision 5 in Regulatory Guide 1.101, "Emergency Response Planning and Preparedness for Nuclear Power Reactors." The letter further stated that NEI 99-01, Revision 5 was acceptable to the NRC staff as an alternative method for developing EALs required in Section IV.B of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4).

BVPS-1 TO NEI 99-01, Revision 5 IC CROSS REFERENCE TABLES

The following tables provide cross-references between the NEI 99-01 Initiating Condition (IC) identification number and the BVPS-1 IC identification number:

NEI to BVPS-1

NEI	BVPS-1	NEI	BVPS-1
FU1	FU1	SU1	SU1
FA1	FA1	SU2	SU5
FS1	FS1	SU3	SU4
FG1	FG1	SU4	SU9
		SU5	SU7
FC1	FC1	SU6	SU6
FC2	FC7	SU8	SU3
FC3	FC3	SA2	SA3
FC4	FC4	SA4	SA4
FC6	FC2	SA5	SA1
FC7	N/A	SS1	SS1
FC8	FC10	SS2	SS3
		SS3	SS2
RC1	RC1	SS6	SS4
RC2	RC5	SG1	SG1
RC4	RC6	SG2	SG3
RC6	RC2		
RC7	N/A	CU1	CU7
RC8	RC10	CU2	CU8
		CU3	CU1
CT1	N/A	CU4	CU10
CT2	CT8	CU6	CU6
CT3	CT3	CU7	CU2
CT4	CT6	CU8	CU3
CT5	CT9	CA1	CA7
CT6	CT2	CA3	CA1
CT7	N/A	CA4	CA10
CT8	CT10	CS1	CS7
		CG1	CG7
AU1	RU1		
AU2	RU2	HU1	HU3
AA1	RA1	HU2	HU4
AA2	RA2	HU3	HU5
AA3	RA3	HU4	HU1
AS1	RS1	HU5	HU6
AG1	RG1	HA1	HA3
		HA2	HA4
		HA3	HA5
		HA4	HA1
		HA5	HA2
		HA6	HA6
		HS2	HS2
		HS3	HS6
		HS4	HS1
		HG1	HG1
		HG2	HG6
		E-HU1	E-HU1

BVPS-1 to NEI

BVPS-1	NEI	BVPS-1	NEI
FG1	FG1	SG1	SG1
FS1	FS1	SS1	SS1
FA1	FA1	SA1	SA5
FU1	FU1	SU1	SU1
		SS2	SS3
FC1	FC1	SG3	SG2
FC2	FC6	SS3	SS2
FC3	FC3	SA3	SA2
FC4	FC4	SU3	SU8
FC7	FC2	SS4	SS6
N/A	FC7	SA4	SA4
FC10	FC8	SU4	SU3
		SU5	SU2
RC1	RC1	SU6	SU6
RC2	RC6	SU7	SU5
RC5	RC2	SU9	SU4
RC6	RC4		
N/A	RC7	CA1	CA3
RC10	RC8	CU1	CU3
		CU2	CU7
N/A	CT1	CU3	CU8
CT2	CT6	CU6	CU6
CT3	CT3	CG7	CG1
CT6	CT4	CS7	CS1
N/A	CT7	CA7	CA1
CT8	CT2	CU7	CU1
CT9	CT5	CU8	CU2
CT10	CT8	CA10	CA4
		CU10	CU4
RG1	AG1		
RS1	AS1	HG1	HG1
RA1	AA1	HS1	HS4
RU1	AU1	HA1	HA4
RA2	AA2	HU1	HU4
RU2	AU2	HS2	HS2
RA3	AA3	HA2	HA5
		HA3	HA1
		HU3	HU1
		HA4	HA2
		HU4	HU2
		HA5	HA3
		HU5	HU3
		HG6	HG2
		HS6	HS3
		HA6	HA6
		HU6	HU5
		E-HU1	E-HU1

DIFFERENCES – DEVIATIONS

The items considered to be differences or deviations are based on the definitions provided in RIS 2003-18, Supplement 2. Any plant EAL [or Initiating Condition (IC) or Fission Product Barrier (FPB) threshold value] that does not meet the intent of the NEI 99-01, Revision 5 guidance or may result in an event being classified differently from the guidance is identified as a deviation and will be listed as such in this evaluation. The basis section for each of the deviations documents the rationale for not adopting the NEI 99-01, Revision 5 guidance. Items identified as deviations will not be implemented without prior NRC review and approval.

ADMINISTRATIVE CHANGES

The following changes apply throughout the set of EALs and are not specifically identified in the comparison tables:

1. The NEI phrase "NOTIFICATION OF UNUSUAL EVENT" has been changed to "UNUSUAL EVENT" to sustain common terminology.

2. The IC identification numbering has been modified to allow consistent grouping by event category.

3. Numerical values, signs and key words of threshold values are **bolded** for emphasis.

4. The NEI note "[T]he Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the [condition will likely exceed the applicable time.] or [duration has exceeded or will likely to exceed, the applicable time.]" is included at the bottom of each page of the EAL matrix located in the proposed Beaver Valley Power Station Emergency Preparedness Plan, Section 4, "Emergency Conditions." An asterisk is used as a pointer to the EAL which requires the use of the note. In this evaluation, for simplicity, the note is included as part of EAL.

5. Terms that are defined in Beaver Valley Power Station Emergency Preparedness Plan, Section 1, "Definitions," are indicated in the proposed BVPS-1 EALs as all capitals.

6. Used the term none instead of not applicable in the FPB matrix.

These changes are considered administrative in nature and are neither a difference nor a deviation in accordance with RIS 2003-18, Supplement 2.

SUMMARY OF DEVIATIONS FROM NEI 99-01

The following table identifies EAL changes that will require prior NRC approval before implementation. A detailed description of the changes and basis for the changes are contained in the following section.

Deviations from NEI 99-01, Revision 5

#	NEI Ref	BVPS-1 Ref	NEI Guidance	Deviation
1	FC1 RC1	FC1 RC1	Heat Sink - Red	Added the conditional statement "Heat Sink is required" to potential loss threshold #2.
2	CT4	CT6	UNISOLABLE steam release from affected SG to the environment	Specified the UNISOLABLE steam release also be prolonged as stated in the NEI generic bases section.
3	AU2	RU2	VALID Area Radiation Monitor reading rise on (site specific list).	Specified that EAL threshold 1.b rise in the radiation monitor reading results in an alarm.
4	CA4	CA10	EAL #2 does not include consideration of temperature monitoring ability.	Added the conditional statement "RCS temperature cannot be monitored" to EAL #2.

Deviation 1

NEI EAL: FC1/RC1 (NEI 99-01, Revision 5) **BVPS-1 EAL:** FC1/RC1

Operational Modes: 1, 2, 3, 4

Description of the Deviation

Added conditional statement: Heat Sink is required.

Technical Basis

The condition "Heat Sink is required" was added to preclude over-classification for conditions in which RCS pressure is less than steam generator pressure or Heat Sink-Red path entry was created by intentional operator action as directed by the EMERGENCY OPERATING PROCEDURE, "Response To Loss Of Secondary Heat Sink."

The heat sink function is not lost until the EMERGENCY OPERATING PROCEDURE methods for temperature control are shown to be unsuccessful. The "Heat Sink is required" conditional statement allows for the use of available alternate cooling methods, such as safety injection operating, prior to determining that the heat sink function is lost or severely degraded when needed.

Supporting Information

A similar change was approved for use at the North Anna Power Station Units 1 and 2, and the Surry Power Station Units 1 and 2. The initial request was dated March 28, 2007 and was approved by the NRC in a letter dated February 4, 2008.

Deviation 2

NEI EAL: CT4 (NEI 99-01, Revision 5) **BVPS-1 EAL:** CT6

Operational Modes: 1, 2, 3, 4

Description of the Deviation

Revised the NEI fission product barrier wording from:

> UNISOLABLE steam release from affected SG to the environment.

To:

> UNISOLABLE prolonged steam release from affected SG to the environment.

Additionally, the criteria for *prolonged* was established in the site specific technical bases sections and as a note to the fission product barrier specifying that a prolonged release is greater than four hours.

Technical Basis

The NEI 99-01, Revision 5 generic basis states the following:

> The threshold for establishing the UNISOLABLE secondary side release is intended to be a prolonged release of radioactivity from the RUPTURED steam generator directly to the environment. This could be expected to occur when the main condenser is unavailable to accept the contaminated steam (i.e., SG tube rupture with concurrent loss of offsite power and the RUPTURED steam generator is required for plant cooldown or a stuck open relief valve).

The previous approved Beaver Valley EAL scheme, based on NUMARC/NESP-007, included the following basis information regarding the clarification and direction for the meaning of prolonged:

> The duration of 'prolonged' is left to Emergency Director judgment but should typically be on the order of 4 to 8 hours in duration.

The lower threshold value of four hours was used to establish the criteria in the Beaver Valley EAL scheme.

The Beaver Valley Site Specific Basis for the EAL also includes the following:

> The threshold for establishing the UNISOLABLE secondary side release is intended to be a prolonged release of radioactivity from the RUPTURED steam generator directly to the environment. This could be expected to occur when the main condenser is unavailable to accept the contaminated steam (i.e., SG tube rupture with concurrent loss of OFFSITE power and the RUPTURED steam generator is required for plant cooldown or a stuck open relief valve). A prolonged release is greater than 4 hours. The 4 hour

duration is the minimum time to cool down to Mode 5, at 100 degrees/hour, per Technical Specification cooldown limits.

Supporting Information

The generic basis wording in NEI 99-01, Revision 5 clearly establishes the intent of the threshold conditions. This change clarifies the threshold consistent with the technical basis to preclude declaring a loss of fission product barrier before it should be declared.

Deviation 3

NEI EAL: AU2 (NEI 99-01, Revision 5) **BVPS-1 EAL:** RU2

Operational Modes: 1, 2, 3, 4, 5, 6, D

Description of the Deviation

Revised the NEI fission product barrier wording from:

> VALID Area Radiation Monitor reading rise on.......

To:

> Area radiation monitor rise resulting in a high-high alarm on.........

Technical Basis

Radiation levels have been shown to rise in instances where water level has been lowered within the technical specification limit. To establish the EAL threshold for an emergency where a departure below the technical specification limit can be readily restored and is clearly within the action statement will result in an event declaration when an event declaration is not warranted.

NRC Information Notice 87-13, "POTENTIAL FOR HIGH RADIATION FIELDS FOLLOWING LOSS OF WATER FROM FUEL POOL," indicates that even for a mishap that does not completely drain the fuel pool, dose rates from components hanging on the sides of the pool railing may result in dose rates in excess of 100 Rem/hour at the pool edge and greater than 1 Rem/hour six feet from the pool edge.

In this case a minimum EAL threshold value has been established at the monitor alarm setpoints. This value is low enough to meet the meaning and intent of the NEI 99-01 Revision 5 EAL technical basis to provide an indication of loss of water level and high enough to preclude an unwarranted emergency declaration.

Supporting Information

A similar change was approved for use at the North Anna Power Station Units 1 and 2, and the Surry Power Station Units 1 and 2. The initial request was dated March 28, 2007 and was approved by the NRC in a letter dated February 4, 2008.

Deviation 4

NEI EAL: CA4.2 (NEI 99-01, Revision 5) **BVPS-1 EAL:** CA10.2

Operational Modes: 5, 6

Description of the Deviation

Revised the NEI EAL wording from:

2. An UNPLANNED event results in RCS pressure increase greater than 10 psi due to a loss of RCS cooling. (PWR-This EAL does not apply in Solid Plant conditions.)

To:

2. a. RCS temperature cannot be monitored.

   AND

   b. RCS pressure rise **> 10 psi** due to an UNPLANNED loss of decay heat removal capability (this EAL does not apply in RCS solid plant conditions).

Technical Basis

EAL #2 provides an alternate indication of reactor coolant system (RCS) heatup resulting from an UNPLANNED loss of decay heat removal capability. This alternate indication may be used in the event that all RCS temperature indication is unavailable. It also provides a more specific escalation path from BVPS-1 CU10.2, which states an UNUSUAL EVENT is warranted with a loss of all RCS temperature and reactor coolant system/reactor pressure vessel level indication for 15 minutes or longer.

Supporting Information

An engineering evaluation was performed which indicated that it would be possible to obtain a 10 psi rise in pressure prior to reaching 200 degrees. The proposed EAL would preclude entry into EAL CA10.1, and would be consistent with regard to escalation from proposed BVPS-1 EAL CU10.2.

The condition associated with the inability to monitor RCS temperature has been addressed by NEI. In the proposed NEI 99-01, Revision 6, the bases for NEI EAL CA4.2 contains wording associated with the inability to monitor RCS temperature. NEI 99-01, Revision 6 has been forwarded to the NRC for review. The loss of RCS temperature condition contained in the proposed BVPS-1 EAL CA10.2 is consistent with this NEI position.

COMPARISON TABLE

The attached table lists the NEI 99-01, Revision 5 Initiating Conditions, Mode Applicability, and EALs (Threshold Values) to the new BVPS-1 EALs. The table also lists the definitions that were added or modified to support the use of the NEI 99-01, Revision 5 EALs. The table provides a means of easily identifying and assessing the differences and deviations between the two EAL/definition sets.

Discussion of EAL technical bases and lists of source document references are contained in the Beaver Valley Power Station Emergency Preparedness Plan, Section 4, "Emergency Conditions." It is, therefore, advisable to reference that document for background information while using this matrix.

The presentation of the EALs within the matrix is provided in a format based on the example table below:

NEI 99-01, Rev 5	**New EALs**	**Differences/Deviations**
EAL Identifier: Initiating Condition: Mode Applicability: Threshold Value(s):	EAL Identifier: Initiating Condition: Mode Applicability: Threshold Value(s):	<u>Differences:</u> <u>Deviations:</u>

Note: Table H-1, which is used to support BVPS-1 EALs HA3, HU3, HA4, and HU4 is located in the Differences/Deviations column, under the summary of differences and deviations. This was done to ensure that the table was located on the same page as the associated EAL.

NEI 99-01 Rev. 5	BVPS-1 Terms	Difference or Deviation
Definitions		
AFFECTING SAFE SHUTDOWN: Event in progress has adversely affected functions that are necessary to bring the plant to and maintain it in the applicable HOT or COLD SHUTDOWN condition. Plant condition applicability is determined by Technical Specification LCOs in effect. Example 1: Event causes damage that results in entry into an LCO that requires the plant to be placed in HOT SHUTDOWN. HOT SHUTDOWN is achievable, but COLD SHUTDOWN is not. This event is not "AFFECTING SAFE SHUTDOWN." Example 2: Event causes damage that results in entry into an LCO that requires the plant to be placed in COLD SHUTDOWN. HOT SHUTDOWN is achievable, but COLD SHUTDOWN is not. This event is "AFFECTING SAFE SHUTDOWN."	**AFFECTING SAFE SHUTDOWN:** Event in progress has adversely affected functions that are necessary to bring the plant to and maintain it in the applicable Hot or Cold Shutdown condition. Plant condition applicability is determined by Technical Specification LCOs in effect. Example 1: Event causes damage that results in entry into an LCO that requires the plant to be placed in Hot Shutdown. Hot Shutdown is achievable, but Cold Shutdown is not. This event is not "AFFECTING SAFE SHUTDOWN." Example 2: Event causes damage that results in entry into an LCO that requires the plant to be placed in Cold Shutdown. Hot Shutdown is achievable, but Cold Shutdown is not. This event is "AFFECTING SAFE SHUTDOWN."	**Rev 5 Differences** Hot and Cold Shutdown not completely capitalized due to not being defined terms in EALs. This is considered administrative. **Rev 5 Deviations** None
BOMB: Refers to an explosive device suspected of having sufficient force to damage plant systems or structures.	**BOMB:** An explosive device suspected of having sufficient force to damage plant systems or structures.	**Rev 5 Differences** None **Rev 5 Deviations** None
CIVIL DISTURBANCE: A group of persons violently protesting station operations or activities at the site.	**CIVIL DISTURBANCE:** A group of persons violently protesting station operations or activities at the site. This event does not involve HOSTILE ACTIONS. Peaceful demonstrations are not CIVIL DISTURBANCEs.	**Rev 5 Differences** Revised for consistency with NEI 03-12, "Template for the Security Plan, Training and Qualification Plan, Safeguards Contingency Plan [and Independent Spent Fuel Storage Installation Security Program]," Revision 6. **Rev 5 Deviations** None
	COMPENSATORY INDICATIONS: Computer points, In-Plant Computer - IPC (U1), Inadequate Core Cooling Monitor - ICCM (U1), Sequence of Events Recorder - SER (U1), Plant Computer System - PCS (U2), Plant Safety Monitoring System - PSMS (U2) and PI Data (ProcessBook®).	**Rev 5 Differences** Added plant specific definition for generic term used in EALs. **Rev 5 Deviations** None
CONFINEMENT BOUNDARY: The barrier(s) between areas containing radioactive substances and the environment.	**CONFINEMENT BOUNDARY:** The barrier(s) between areas containing radioactive substances and the environment.	**Rev 5 Differences** None **Rev 5 Deviations** None
CONTAINMENT CLOSURE: The site specific procedurally defined actions taken to secure containment (primary or secondary for BWR) and its associated structures, systems, and components as a functional barrier to fission product release under existing plant conditions.	**CONTAINMENT CLOSURE:** The procedurally defined actions taken to secure primary containment and its associated structures, systems, and components as a functional barrier to fission product release under existing plant conditions.	**Rev 5 Differences** None. Removal of site specific and plant type placeholders from the template is considered administrative. **Rev 5 Deviations** None
EMERGENCY ACTION LEVEL (EAL): A pre-determined, site specific, observable threshold for a plant IC that places the plant in a given emergency classification level. An EAL can be: an instrument reading; an equipment status indicator; a measurable parameter (on-site or off-site); a discrete, observable event; results of analyses; entry into specific emergency operating procedures; or another phenomenon which, if it occurs, indicates entry into a particular emergency classification level.	**EMERGENCY ACTION LEVEL (EAL):** A pre-determined, site specific, observable threshold for a plant IC that places the plant in a given EMERGENCY CLASSIFICATION LEVEL. An EAL can be: an instrument reading; an equipment status indicator; a measurable parameter (ONSITE or OFFSITE); a discrete, observable event; results of analyses; entry into specific EMERGENCY OPERATING PROCEDURES; or another phenomenon which, if it occurs, indicates entry into a particular EMERGENCY CLASSIFICATION LEVEL.	**Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 Terms	Difference or Deviation
EXPLOSION: A rapid, violent, unconfined combustion, or catastrophic failure of pressurized/energized equipment that imparts energy of sufficient force to potentially damage permanent structures, systems, or components.	**EXPLOSION:** A rapid, violent, unconfined combustion, or catastrophic failure of pressurized/energized equipment that imparts energy of sufficient force to potentially damage permanent structures, systems, or components.	**Rev 5 Differences** None **Rev 5 Deviations** None
EXTORTION: An attempt to cause an action at the station by threat of force.	**EXTORTION:** An attempt to cause an action at the station by threat of force.	**Rev 5 Differences** None **Rev 5 Deviations** None
FAULTED: (PWRs) in a steam generator, the existence of secondary side leakage that results in an uncontrolled drop in steam generator pressure or the steam generator being completely depressurized.	**FAULTED:** In a steam generator, the existence of secondary side leakage that results in an uncontrolled drop in steam generator pressure or the steam generator being completely depressurized.	**Rev 5 Differences** None. Removal of site specific and plant type placeholders from the template is considered administrative. **Rev 5 Deviations** None
FIRE: Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute FIRES. Observation of flame is preferred but is NOT required if large quantities of smoke and heat are observed.	**FIRE:** Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute FIRE. Observation of flame is preferred but is not required if large quantities of smoke and heat are observed.	**Rev 5 Differences** None. Word corrected to singular is considered administrative. **Rev 5 Deviations** None
HOSTAGE: A person(s) held as leverage against the station to ensure that demands will be met by the station.	**HOSTAGE:** A person(s) held as leverage against the station to ensure that demands will be met by the station.	**Rev 5 Differences** None **Rev 5 Deviations** None
HOSTILE ACTION: An act toward a NPP or its personnel that includes the use of violent force to destroy equipment, take HOSTAGES, and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, PROJECTILEs, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. HOSTILE ACTION should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on the NPP. Non-terrorism-based EALs should be used to address such activities (i.e., this may include violent acts between individuals in the owner controlled area).	**HOSTILE ACTION:** An act toward a nuclear power plant or its personnel that includes the use of violent force to destroy equipment, take HOSTAGES, and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, PROJECTILES, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. HOSTILE ACTION should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on the nuclear power plant. Non-terrorism-based EALs should be used to address such activities (i.e., violent acts between individuals in the OWNER CONTROLLED AREA).	**Rev 5 Differences** None. Spelling out of the abbreviation is considered administrative. Eliminated the phrase "this may include" in the last sentence for it is considered redundant verbiage. **Rev 5 Deviations** None
IMMINENT: Mitigation actions have been ineffective, additional actions are not expected to be successful, and trended information indicates that the event or condition will occur. Where IMMINENT timeframes are specified, they shall apply.	**IMMINENT / IMPENDING:** Means about to happen (generally within 30 minutes).	**Rev 5 Differences** Revised for consistency with NEI 03-12, Rev 6. **Rev 5 Deviations** None
INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI): A complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage.	**INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI):** A complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage.	**Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 Terms	Difference or Deviation
INTRUSION: A person(s) present in a specified area without authorization. Discovery of a BOMB in a specified area is indication of INTRUSION into that area by a HOSTILE FORCE.	**INTRUDER / INTRUSION:** A person(s) present in a specified area without authorization. Discovery of a BOMB in a specified area is indication of INTRUSION into that area by a HOSTILE FORCE.	**Rev 5 Differences** Term "INTRUDER" was added for consistency with the first sentence of the definition that applied to a person. This is considered administrative. **Rev 5 Deviations** None
	LARGE AIRCRAFT: Any size or type of aircraft with the potential for causing significant damage to the plant (refer to the Security Plan for a more detailed definition).	**Rev 5 Differences** Added the definition for "LARGE AIRCRAFT" in accordance with NEI 99-01 Rev 5 FAQ #26. **Rev 5 Deviations** None
	NORMAL LEVELS: The highest reading in the past twenty-four hours excluding the current peak value.	**Rev 5 Differences** Added the definition for "NORMAL LEVELS" in accordance with NEI 99-01 Rev 5, FAQ# 5. **Rev 5 Deviations** None
NORMAL PLANT OPERATIONS: Activities at the plant site associated with routine testing, maintenance, or equipment operations, in accordance with normal operating or administrative procedures. Entry into abnormal or emergency operating procedures, or deviation from normal security or radiological controls posture, is a departure from NORMAL PLANT OPERATIONS.	**NORMAL PLANT OPERATIONS:** Activities at the plant site associated with routine testing, maintenance, or equipment operations, in accordance with normal operating or administrative procedures. Entry into abnormal or EMERGENCY OPERATING PROCEDURES, or deviation from normal security or radiological controls posture, is a departure from NORMAL PLANT OPERATIONS.	**Rev 5 Differences** None **Rev 5 Deviations** None
	OWNER CONTROLLED AREA: The property associated with the station and owned by the company. Access is normally limited to persons entering for official business.	**Rev 5 Differences** Added plant specific definition for generic term used in EALs. **Rev 5 Deviations** None
PROJECTILE: An object directed toward a NPP that could cause concern for its continued operability, reliability, or personnel safety.	**PROJECTILE:** Means a fired, projected object, such as a bullet or pellet having no capacity for self propulsion directed towards a nuclear power plant that could cause concern for its continued operability, reliability or personnel safety.	**Rev 5 Differences** Revised for consistency with NEI 03-12, Rev 6. **Rev 5 Deviations** None
PROTECTED AREA: Typically the site specific area which normally encompasses all controlled areas within the security PROTECTED AREA fence.	**PROTECTED AREA:** Means an area encompassed by physical barriers and to which access is controlled.	**Rev 5 Differences** Revised for consistency with NEI 03-12, Rev 6. **Rev 5 Deviations** None
RUPTURED: (PWRs) in a steam generator, existence of primary-to-secondary leakage of a magnitude sufficient to require or cause a reactor trip and safety injection.	**RUPTURED:** In a steam generator, existence of primary-to-secondary leakage of a magnitude sufficient to require or cause a reactor trip and safety injection.	**Rev 5 Differences** None. Removal of site specific and plant type placeholders from the template is considered administrative. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 Terms	Difference or Deviation
SABOTAGE: Deliberate damage, mis-alignment, or mis-operation of plant equipment with the intent to render the equipment inoperable. Equipment found tampered with or damaged due to malicious mischief may not meet the definition of SABOTAGE until this determination is made by security supervision.	**SABOTAGE:** Deliberate damage, mis-alignment, or mis-operation of plant equipment with the intent to render the equipment inoperable. Equipment found tampered with or damaged due to malicious mischief may not meet the definition of SABOTAGE until this determination is made by security supervision.	**Rev 5 Differences** None **Rev 5 Deviations** None
SECURITY CONDITION: Any Security Event as listed in the approved security contingency plan that constitutes a threat/compromise to site security, threat/risk to site personnel, or a potential degradation to the level of safety of the plant. A SECURITY CONDITION does not involve a HOSTILE ACTION.	**SECURITY CONDITION:** Any Security Event as listed in the approved security contingency plan that constitutes a threat/compromise to site security, threat/risk to site personnel, or a potential degradation to the level of safety of the plant. A SECURITY CONDITION does not involve a HOSTILE ACTION.	**Rev 5 Differences** None **Rev 5 Deviations** None
SIGNIFICANT TRANSIENT: An UNPLANNED event involving one or more of the following: (1) automatic turbine runback greater than 25% thermal reactor power, (2) electrical load rejection greater than 25% full electrical load, (3) Reactor Trip, (4) Safety Injection Activation, or (5) thermal power oscillations greater than 10%.		**Rev 5 Differences** Removed significant transient definition in accordance with NEI 99-01 Rev 5, FAQ# 39. **Rev 5 Deviations** None
STRIKE ACTION: A work stoppage within the PROTECTED AREA by a body of workers to enforce compliance with demands made on (site specific). The STRIKE ACTION must threaten to interrupt NORMAL PLANT OPERATIONS.	**STRIKE ACTION:** A work stoppage within the PROTECTED AREA by a body of workers to enforce compliance with demands made on management. The STRIKE ACTION must threaten to interrupt NORMAL PLANT OPERATIONS.	**Rev 5 Differences** None **Rev 5 Deviations** None
UNISOLABLE: A breach or leak that cannot be promptly isolated.	**UNISOLABLE:** A breach or leak that cannot be promptly isolated.	**Rev 5 Differences** None **Rev 5 Deviations** None
UNPLANNED: A parameter change or an event that is not the result of an intended evolution and requires corrective or mitigative actions.	**UNPLANNED:** A parameter change or an event, the reasons for which may be known or unknown, that is not the result of an intended evolution or expected plant response to a transient.	**Rev 5 Differences** Change to the definition for "UNPLANNED" in accordance with NEI 99-01 Rev 5, FAQ# 10. **Rev 5 Deviations** None
VALID: An indication, report, or condition, is considered to be VALID when it is verified by (1) an instrument channel check, (2) indications on related or redundant indicators, or (3) by direct observation by plant personnel, such that doubt related to the indicator's operability, the condition's existence, or the report's accuracy is removed. Implicit in this definition is the need for timely assessment.	**VALID:** An indication, report, or condition, is considered to be VALID when it is verified by (1) an instrument channel check, (2) indications on related or redundant indicators, or (3) by direct observation by plant personnel, such that doubt related to the indicator's operability, the condition's existence, or the report's accuracy is removed. Implicit in this definition is the need for timely assessment.	**Rev 5 Differences** None **Rev 5 Deviations** None
VISIBLE DAMAGE: Damage to equipment or structure that is readily observable without measurements, testing, or analysis. Damage is sufficient to cause concern regarding the continued operability or reliability of the affected structure, system, or component. Example damage includes: deformation due to heat or impact, denting, penetration, rupture, cracking, and paint blistering. Surface blemishes (e.g., paint chipping, scratches) should not be included.	**VISIBLE DAMAGE:** Damage to equipment or structure that is readily observable without measurements, testing, or analysis. Damage is sufficient to cause concern regarding the continued availability or reliability of the affected structure, system, or component. Example damage includes: deformation due to heat or impact, denting, penetration, rupture, cracking, and paint blistering. Surface blemishes (e.g., paint chipping, scratches) should not be included.	**Rev 5 Differences** The word "operability" was replaced with "availability". This is done to avoid confusion with the need to establish Technical Specification OPERABILITY when determining EAL applicability. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 Terms	Difference or Deviation
VITAL AREAS: Typically any site specific areas, normally within the PROTECTED AREA, that contains equipment, systems, components, or material, the failure, destruction, or release of which could directly or indirectly endanger the public health and safety by exposure to radiation.	**VITAL AREA:** Means any area that contains VITAL EQUIPMENT.	**Rev 5 Differences** Revised for consistency with NEI 03-12, Rev 6. **Rev 5 Deviations** None
	VITAL EQUIPMENT: Means any equipment, system, device, or material, the failure, destruction, or release of which could directly or indirectly endanger the public health and safety by exposure to radiation. Equipment or systems which would be required to function to protect public health and safety following such failure, destruction, or release are also considered to be vital.	**Rev 5 Differences** Revised for consistency with NEI 03-12, Rev 6. **Rev 5 Deviations** None
EMERGENCY CLASSIFICATION LEVELS		
NOTIFICATION OF UNUSUAL EVENT: Events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring off-site response or monitoring are expected unless further degradation of safety systems occurs.	**UNUSUAL EVENT:** Events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring OFFSITE response or monitoring are expected unless further degradation of safety systems occurs.	**Rev 5 Differences** None **Rev 5 Deviations** None
ALERT: Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA PAG exposure levels.	**ALERT:** Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA PROTECTIVE ACTION GUIDE exposure levels.	**Rev 5 Differences** None. Spelling out of the abbreviation is considered administrative. **Rev 5 Deviations** None
SITE AREA EMERGENCY: Events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts; 1) toward site personnel or equipment that could lead to the likely failure of or; 2) that prevent effective access to, equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PAG exposure levels beyond the site boundary.	**SITE AREA EMERGENCY:** Events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts; 1) toward site personnel or equipment that could lead to the likely failure of or; 2) that prevent effective access to, equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PROTECTIVE ACTION GUIDE exposure levels beyond the site boundary.	**Rev 5 Differences** None. Spelling out of the abbreviation is considered administrative. **Rev 5 Deviations** None
GENERAL EMERGENCY: Events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PAG exposure levels off-site for more than the immediate site area.	**GENERAL EMERGENCY:** Events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PROTECTIVE ACTION GUIDE exposure levels OFFSITE for more than the immediate site area.	**Rev 5 Differences** None. Spelling out of the abbreviation is considered administrative. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
Fission Product Barrier Degradation		
FG1 Loss of ANY Two Barriers AND Loss or Potential Loss of the third barrier. Op. Modes: Power Operation, Hot Standby, Startup, Hot Shutdown	**FG1** **Initiating Condition:** Loss of any two barriers and loss or potential loss of the third barrier. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** Refer to fission product barrier loss and potential loss threshold values to determine barrier status.	**Rev 5 Differences** None **Rev 5 Deviations** None
FS1 Loss or Potential Loss of ANY two barriers. Op. Modes: Power Operation, Hot Standby, Startup, Hot Shutdown	**FS1** **Initiating Condition:** Loss or potential loss of any two barriers. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** Refer to fission product barrier loss and potential loss threshold values to determine barrier status.	**Rev 5 Differences** None **Rev 5 Deviations** None
FA1 ANY Loss or ANY Potential Loss of EITHER Fuel Clad OR RCS. Op. Modes: Power Operation, Hot Standby, Startup, Hot Shutdown	**FA1** **Initiating Condition:** Any loss or any potential loss of either fuel clad or RCS. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** Refer to fission product barrier loss and potential loss threshold values to determine barrier status.	**Rev 5 Differences** None **Rev 5 Deviations** None
FU1 ANY Loss or ANY Potential Loss of Containment. Op. Modes: Power Operation, Hot Standby, Startup, Hot Shutdown	**FU1** **Initiating Condition:** Any loss or any potential loss of containment. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** Refer to fission product barrier loss and potential loss threshold values to determine barrier status.	**Rev 5 Differences** None **Rev 5 Deviations** None
Fuel Clad Barrier		
1. Critical Safety Function Status **Loss** A. Core-Cooling Red Entry Conditions Met. **Potential Loss** A. Core Cooling - Orange Entry Conditions Met. **OR** B. Heat Sink - Red Entry Conditions Met.	**FC1: Critical Safety Function Status** **Loss** 1. Core Cooling - Red entry conditions met. **Potential Loss** 1. Core Cooling - Orange entry conditions met. **OR** 2. a. Heat Sink - Red entry conditions met. **AND** b. Heat Sink is required.	**Rev 5 Differences** None **Rev 5 Deviations** The conditional statement "Heat Sink is required" was added as a condition to potential loss threshold #2.

<table>
<tr><th>NEI 99-01 Rev. 5</th><th>BVPS-1 EALs</th><th>Difference or Deviation</th></tr>
<tr><td>6. Containment Radiation Monitoring
<u>Loss</u>
A. Containment radiation monitor reading greater than (site specific value).
<u>Potential Loss</u>
Not Applicable</td><td>FC2: Containment Radiation Monitoring
<u>Loss</u>
1. Containment Radiation Monitor (RM-1RM-219A or B) > FC2 Line on Graph F-1.
<u>Potential Loss</u>
None</td><td><u>Rev 5 Differences</u>
Removed the word "reading" for human factors considerations (minimize extraneous words).
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td>3. Core Exit Thermocouple Readings
<u>Loss</u>
A. Core exit thermocouples reading greater than (site specific degree F).
<u>Potential Loss</u>
A. Core exit thermocouples reading greater than (site specific degree F).</td><td>FC3: Core Temperature
<u>Loss</u>
1. Five hottest core exit thermocouples > 1200° F.
<u>Potential Loss</u>
1. Five hottest core exit thermocouples > 719° F.</td><td><u>Rev 5 Differences</u>
Used a generalized fission product barrier (FPB) category title for fleet standardization.
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td>4. Reactor Vessel Water Level
<u>Loss</u>
Not Applicable
<u>Potential Loss</u>
A. RSC/RPV level less than (site specific level for TOAF).</td><td>FC4: RCS Level
<u>Loss</u>
None
<u>Potential Loss</u>
1. RCS level < Table F-1.
<table><tr><th colspan="3">Table F-1: RVLIS Thresholds</th></tr><tr><th>RVLIS</th><th>RCPs</th><th>Indication</th></tr><tr><td>Full Range</td><td>0</td><td>40%</td></tr><tr><td rowspan="3">Dynamic Range</td><td>1</td><td>25%</td></tr><tr><td>2</td><td>33%</td></tr><tr><td>3</td><td>60%</td></tr></table></td><td><u>Rev 5 Differences</u>
None
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td>2. Primary Coolant Activity Level
<u>Loss</u>
A. Coolant activity greater than (site specific value).
<u>Potential Loss</u>
Not Applicable</td><td>FC7: RCS Activity
<u>Loss</u>
1. Coolant activity > 300 μCi/gm dose equivalent I-131.
<u>Potential Loss</u>
None</td><td><u>Rev 5 Differences</u>
None
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td>7. Other Site Specific Indications
<u>Loss</u>
A. (site specific) as applicable.
<u>Potential Loss</u>
A. (site specific) as applicable.</td><td>N/A</td><td><u>Note:</u> BVPS-1 does not have any additional FPB thresholds in this category.
<u>Rev 5 Differences</u>
None
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td>8. Emergency Director Judgment
<u>Loss</u>
A. Any condition in the opinion of the Emergency Director that indicates Loss of the Fuel Clad Barrier.
<u>Potential Loss</u>
A. Any condition in the opinion of the Emergency Director that indicates Potential Loss of the Fuel Clad Barrier.</td><td>FC10: EMERGENCY DIRECTOR Judgment
<u>Loss</u>
1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the fuel clad barrier.
<u>Potential Loss</u>
1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the fuel clad barrier.</td><td><u>Rev 5 Differences</u>
None
<u>Rev 5 Deviations</u>
None</td></tr>
</table>

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
RCS Barrier		
1. Critical Safety Function Status **Loss** Not Applicable **Potential Loss** A. RCS Integrity - Red Entry Conditions Met. **OR** B. Heat Sink - Red Entry Conditions Met.	**RC1: Critical Safety Function Status** **Loss** None **Potential Loss** 1. RCS Integrity - Orange entry conditions met. **OR** 2. a. Heat Sink - Red entry conditions met. **AND** b. Heat Sink is required.	**Rev 5 Differences** None **Rev 5 Deviations** The conditional statement "Heat Sink is required" was added as a condition to potential loss threshold #2.
6. Containment Radiation Monitoring **Loss** A. Containment radiation monitor reading greater than (site specific value). **Potential Loss** Not Applicable	**RC2: Containment Radiation Monitoring** **Loss** 1. Containment Radiation Monitor (RM-1RM-219A or B) **> 8 R/hr (RC2 Line on Graph F-1)**. **Potential Loss** None	**Rev 5 Differences** Removed the word "reading" for human factors considerations (minimize extraneous words). **Rev 5 Deviations** None
2. RCS Leak Rate **Loss** A. RCS leak rate greater than available makeup capacity as indicated by a loss of RCS subcooling. **Potential Loss** A. RCS leak rate indicated greater than (site specific capacity of one charging pump in the normal charging mode) with Letdown isolated.	**RC5: RCS Leak Rate** **Loss** 1. RCS leak rate greater than available makeup capacity as indicated by RCS subcooling **< 18° normal containment or < 33° adverse containment**. **Potential Loss** 1. UNISOLABLE RCS leak exceeding the capacity of one charging pump (129 gpm) in the normal charging mode.	**Rev 5 Differences** (Potential Loss): Removed "with Letdown isolated" to simplify recognition conditions. (Potential Loss): Added "UNISOLABLE" to clarify that the intent is not to declare an emergency for a momentary leak that can be operationally isolated. **Rev 5 Deviations** None
4. SG Tube Rupture **Loss** A. RUPTURED SG results in an ECCS (SI) actuation. **Potential Loss** Not Applicable	**RC6: SG Tube Leakage / Rupture** **Loss** 1. RUPTURED SG results in an SI actuation. **Potential Loss** None	**Rev 5 Differences** Added leakage to FPB category title to allow for consistent language with CT6 (NEI CT4) and fleet standardization. **Rev 5 Deviations** None
7. Other Site Specific Indications **Loss** A. (site specific) as applicable. **Potential Loss** A. (site specific) as applicable.	N/A	**Note:** BVPS-1 does not have any additional FPB thresholds in this category. **Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
8. Emergency Director Judgment **Loss** A. Any condition in the opinion of the Emergency Director that indicates Loss of the RCS Barrier. **Potential Loss** A. Any condition in the opinion of the Emergency Director that indicates Potential Loss of the RCS Barrier.	**RC10. EMERGENCY DIRECTOR Judgment** **Loss** 1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the RCS barrier. **Potential Loss** 1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the RCS barrier.	**Rev 5 Differences** None **Rev 5 Deviations** None
Containment Barrier		
1. Critical Safety Function Status **Loss** Not Applicable **Potential Loss** A. Containment - Red Entry Conditions Met.	**CT1: Critical Safety Function Status** **Loss** None **Potential Loss** 1. Containment - Red Entry Conditions Met.	**Rev 5 Differences** None **Rev 5 Deviations** None
6. Containment Radiation Monitoring **Loss** Not Applicable **Potential Loss** A. Containment radiation monitor reading greater than (site specific value).	**CT2: Containment Radiation Monitoring** **Loss** None **Potential Loss** 1. Containment Radiation Monitor (RM-1RM-219A or B) **> CT2 Line on Graph F-1**.	**Rev 5 Differences** Removed the word "reading" for human factors considerations (minimize extraneous words). **Rev 5 Deviations** None
3. Core Exit Thermocouple Readings **Loss** Not Applicable **Potential Loss** A. a. Core exit thermocouples in excess of (site specific)° F. **AND** b. Restoration procedures not effective within 15 minutes. **OR** B. a. Core exit thermocouples in excess of (site specific) F. **AND** b. Reactor vessel level below (site specific level). **AND** c. Restoration procedures not effective within 15 minutes.	**CT3: Core Temperature** **Loss** None **Potential Loss** 1. a. Five hottest core exit thermocouples **> 2000° F**. **AND** b. Restoration procedures not effective within **15 minutes**. **OR** 2. a. Five hottest core exit thermocouples **> 1200° F** **AND** b. RVLIS Full Range **< 40%** with no RCPs running. **AND** c. Restoration procedures not effective within **15 minutes**.	**Rev 5 Differences** Used a generalized FPB category title for fleet standardization terminology. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
4. SG Secondary Side Release with P-to-S Leakage **Loss** A. RUPTURED SG is also FAULTED outside of containment. **OR** B. a. Primary-to-Secondary leakrate greater than 10 gpm. **AND** b. UNISOLABLE steam release from affected SG to the environment. **Potential Loss** Not Applicable	**CT6: SG Tube Leakage / Rupture** **Loss** **Note:** A prolonged release is greater than 4 hours. 1. RUPTURED SG is also FAULTED outside of containment. **OR** 2. a. Primary-to-Secondary leak rate **> 10 gpm**. **AND** b. UNISOLABLE prolonged steam release from affected SG to the environment. **Potential Loss** None	**Rev 5 Differences** Revised FPB category title to allow for consistent language with RC6 (NEI RC4) and fleet standardization. Defined the generic basis section term "prolonged" in the site specific basis section and added a note to the EAL section. A prolonged release is greater than 4 hours. The 4 hour duration is the minimum time to cool down to Mode 5, at 100 degrees/hr, per Technical Specification cooldown limits. **Rev 5 Deviations** Specified the UNISOLABLE steam release also be prolonged as stated in the NEI generic bases section.
2. Containment Pressure **Loss** A. A containment pressure rise followed by a rapid unexplained drop in containment pressure. **OR** B. Containment pressure or sump level response not consistent with LOCA conditions. **Potential Loss** A. Containment pressure greater than (site specific value) and rising. **OR** B. Explosive mixture exists inside containment. **OR** C. a. Pressure greater than containment depressurization actuation setpoint. **AND** b. Less than one full train of depressurization equipment operating.	**CT8: Containment Pressure** **Loss** 1. A containment pressure rise followed by a rapid UNPLANNED drop in containment pressure. **OR** 2. Containment pressure or sump level response not consistent with LOCA conditions. **Potential Loss** 1. Containment pressure **> 45 psig** and rising. **OR** 2. Containment hydrogen **> 4%.** **OR** 3. a. Containment pressure **> 11 psig.** **AND** b. Less than one full train of depressurization equipment operating.	**Rev 5 Differences** Replaced "unexplained" with "UNPLANNED" in accordance with NEI 99-01 Rev 5, FAQ# 10. **Rev 5 Deviations** None
5. Containment Isolation Failure or Bypass **Loss** A. a. Failure of all valves in any one line to close. **AND** b. Direct downstream pathway to the environment exists after containment isolation signal. **Potential Loss** Not Applicable	**CT9: Containment Isolation Failure** **Loss** **Note:** Direct pathways include filtered pathways (e.g., SLCRS). 1. a. Failure of **ALL** valves in any one line to close. **AND** b. Direct downstream pathway to the environment exists after containment isolation signal. **Potential Loss** None	**Rev 5 Differences** Revised FPB category title to eliminate bypass reference as there is no threshold for a containment bypass event and fleet standardization. Added a note to the EAL section to clarify that direct downstream pathways include filtered pathways as reworded from the basis section: "The existence of an in-line charcoal filter does not make a release path indirect since the filter is not effective at removing fission product noble gases." Supplementary leak collection and release system (SLCRS) is a filtered pathway. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
7. **Other Site Specific Indications** **Loss** A. (site specific) as applicable. **Potential Loss** A. (site specific) as applicable.	N/A	**Note:** BVPS-1 does not have any additional FPB thresholds in this category. **Rev 5 Differences** None **Rev 5 Deviations** None
8. Emergency Director Judgment **Loss** A. Any condition in the opinion of the Emergency Director that indicates Loss of the Containment Barrier. **Potential Loss** A. Any condition in the opinion of the Emergency Director that indicates Potential Loss of the Containment Barrier.	**CT10: EMERGENCY DIRECTOR Judgment** **Loss** 1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the containment barrier. **Potential Loss** 1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the containment barrier.	**Rev 5 Differences** None **Rev 5 Deviations** None
Abnormal Rad Condition / Abnormal Rad Effluent Releases		
AG1 **Initiating Condition - GENERAL EMERGENCY** Off-site dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 1000 mrem TEDE or 5000 mrem Thyroid CDE for the actual or projected duration of the release using actual meteorology. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3 or 4) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results. 1. VALID reading on **ANY** of the following radiation monitors greater than the reading shown for 15 minutes or longer: (site specific monitor list and threshold values) 2. Dose assessment using actual meteorology indicates doses greater than 1000 mrem TEDE or 5000 mrem thyroid CDE at or beyond the site boundary. 3. VALID perimeter radiation monitoring system reading greater than 1000 mR/hr for 15 minutes or longer. [for sites having telemetered perimeter monitors] 4. Field survey results indicate closed window dose rates greater than 1000 mR/hr expected to continue for 60 minutes or longer; or analyses of field survey samples indicate thyroid CDE greater than 5000 mrem for one hour of inhalation, at or beyond site boundary.	**RG1** **INITIATING CONDITION:** OFFSITE dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** **Notes:** • The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. • If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results. 1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **15 minutes** or longer: • SLCRS Vent (RM-1VS-110 Ch 7) .... **7.66E+02 cpm** • Ventilation Vent (RM-1VS-109 Ch 7) .... **6.42E+02 cpm** **OR** 2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER** of the following: • **> 1000 mRem** TEDE. • **> 5000 mRem** CDE Child Thyroid. **OR** 3. Field survey results at or beyond the site boundary indicate **EITHER** of the following: • Gamma (closed window) dose rate **> 1000 mR/hr** for **60 minutes** or longer. • Air sample analysis **> 5000 mRem** CDE Child Thyroid for one hour of inhalation.	**Note:** The EAL thresholds reflect state guidance which evaluate the consequences of radiological releases in terms of a CDE Child Thyroid PAG rather than an EPA-400 CDE Thyroid PAG. **Rev 5 Differences** Provided mRem capitalization consistent with fleet standards in accordance with NEI 99-01 Rev 5, FAQ# 8. Removed "VALID" in accordance with NEI 99-01 Rev 5, FAQ# 4. Removed the word "reading" for human factors considerations (minimize extraneous words). NEI AG1.3 is not applicable (N/A) for BVPS-1 because the plant is not equipped with a perimeter radiation monitoring system. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
AS1 **Initiating Condition - SITE AREA EMERGENCY** Off-site dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 100 mrem TEDE or 500 mrem Thyroid CDE for the actual or projected duration of the release. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3 or 4) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results. 1. VALID reading on **ANY** of the following radiation monitors greater than the reading shown for 15 minutes or longer: (site specific monitor list and threshold values) 2. Dose assessment using actual meteorology indicates doses greater than 100 mrem TEDE or 500 mrem thyroid CDE at or beyond the site boundary. 3. VALID perimeter radiation monitoring system reading greater than 100 mR/hr for 15 minutes or longer. [for sites having telemetered perimeter monitors] 4. Field survey results indicate closed window dose rates greater than 100 mR/hr expected to continue for 60 minutes or longer; or analyses of field survey samples indicate thyroid CDE greater than 500 mrem for one hour of inhalation, at or beyond the site boundary.	**RS1** **INITIATING CONDITION:** OFFSITE dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 100 mRem TEDE or 500 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** **Notes:** • The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. • If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results. 1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **15 minutes*** or longer: • SLCRS Vent (RM-1VS-110 Ch 7) .... **7.66E+01 cpm** • Ventilation Vent (RM-1VS-109 Ch 7).............................. **6.42E+01 cpm** **OR** 2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER** of the following: • **> 100 mRem** TEDE. • **> 500 mRem** CDE Child Thyroid. **OR** 3. Field survey results at or beyond the site boundary indicate **EITHER** of the following: • Gamma (closed window) dose rate **> 100 mR/hr** for **60 minutes** or longer. • Air sample analysis **> 500 mRem** CDE Child Thyroid for one hour of inhalation.	**Note:** The EAL thresholds reflect state guidance which evaluate the consequences of radiological releases in terms of a CDE Child Thyroid PAG rather than an EPA-400 CDE Thyroid PAG. **Rev 5 Differences** Added IC wording "using actual meteorology" in accordance with NEI 99-01 Rev 5, FAQ# 9. Provided mRem capitalization consistent with fleet standards in accordance with NEI 99-01 Rev 5, FAQ# 8. Removed "VALID" in accordance with NEI 99-01 Rev 5, FAQ# 4. Removed the word "reading" for human factors considerations (minimize extraneous words). NEI AS1.3 is N/A for BVPS-1 because the plant is not equipped with a perimeter radiation monitoring system. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
<u>AA1</u> **Initiating Condition - ALERT** Any release of gaseous or liquid radioactivity to the environment greater than 200 times the Radiological Effluent Technical Specifications/ODCM for 15 minutes or longer. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3 or 4 or 5) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown. 1. VALID reading on **ANY** of the following radiation monitors greater than the reading shown for 15 minutes or longer: (site specific monitor list and threshold values) 2. VALID reading on any effluent monitor reading that greater than 200 times the alarm setpoint established by a current radioactivity discharge permit for 15 minutes or longer. 3. Confirmed sample analyses for gaseous or liquid releases indicates concentrations or release rates greater than 200 times (site specific RETS values) for 15 minutes or longer. 4. VALID reading on perimeter radiation monitoring system reading greater than 10.0 mR/hr above normal* background for 15 minutes or longer. [for sites having telemetered perimeter monitors] 5. VALID indication on automatic real-time dose assessment capability indicating greater than (site specific value) for 15 minutes or longer. [for sites having such capability] * Normal can be considered as the highest reading in the past twenty-four hours excluding the current peak value.	<u>RA1</u> **INITIATING CONDITION:** Any release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM limit for 15 minutes or longer. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** **<u>Note:</u>** • The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, will likely exceed the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown. 1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **15 minutes** or longer: • SLCRS Vent (RM-1VS-110 Ch 5) .... **6.76E+05 cpm** • Ventilation Vent (RM-1VS-109 Ch 5).............................. **2.94E+05 cpm** **OR** 2. **ANY** of the following liquid effluent monitors **> 200 times the High-High alarm setpoint, not to exceed 8.5E+05 cpm,** established by a current radioactivity discharge permit for **15 minutes** or longer • Liquid Waste Effluent Monitor (RM-1LW-104) • Laundry and Contaminated Shower Drains Monitor (RM-1LW-116) **OR** 3. Confirmed sample analysis for gaseous or liquid releases **> 200 times the ODCM limit** for **15 minutes** or longer.	**<u>Rev 5 Differences</u>** Removed "VALID" in accordance with NEI 99-01 Rev 5, FAQ# 4. Established "NORMAL LEVELS" as a defined term in accordance with NEI 99-01 Rev 5, FAQ# 5. Removed the words "reading" for human factors considerations (minimize extraneous words). NEI AA1.4 is N/A for BVPS-1 because the plant is not equipped with a perimeter radiation monitoring system. NEI AA1.5 is N/A for BVPS-1 because the plant is not equipped with a automatic real-time dose assessment system. **<u>Rev 5 Deviations</u>** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
AU1 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Any release of gaseous or liquid radioactivity to the environment greater than 2 times the Radiological Effluent Technical Specifications/ODCM for 60 minutes or longer. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3 or 4 or 5) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown. 1. VALID reading on **ANY** of the following radiation monitors greater than the reading shown for 60 minutes or longer: (site specific monitor list and threshold values) 2. VALID reading on any effluent monitor reading greater than 2 times the alarm setpoint established by a current radioactivity discharge permit for 60 minutes or longer. 3. Confirmed sample analyses for gaseous or liquid releases indicates concentrations or release rates greater than 2 times (site specific RETS values) for 60 minutes or longer. 4. VALID reading on perimeter radiation monitoring system reading greater than 0.10 mR/hr above normal* background for 60 minutes or longer. [for sites having telemetered perimeter monitors] 5. VALID indication on automatic real-time dose assessment capability indicating greater than (site specific value) for 60 minutes or longer. [for sites having such capability] * Normal can be considered as the highest reading in the past twenty-four hours excluding the current peak value.	**RU1** **INITIATING CONDITION:** Any release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes or longer. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** **Note:** • The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown. 1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **60 minutes** or longer: • SLCRS Vent (RM-1VS-110 Ch 5) .... **6.76E+03 cpm** • Ventilation Vent (RM-1VS-109 Ch 5)............................... **2.94E+03 cpm** **OR** 2. **ANY** of the following liquid effluent monitors **> 2 times the High-High alarm setpoint** established by a current radioactivity discharge permit for **60 minutes** or longer: • Liquid Waste Effluent Monitor (RM-1LW-104) • Laundry and Contaminated Shower Drains Monitor (RM-1LW-116) **OR** 3. Confirmed sample analysis for gaseous or liquid releases **> 2 times the ODCM limit** for **60 minutes** or longer.	**Rev 5 Differences** Removed "VALID" in accordance with NEI 99-01 Rev 5, FAQ# 4. Established "NORMAL LEVELS" as a defined term in accordance with NEI 99-01 Rev 5, FAQ# 5. Removed the words "reading" for human factors considerations (minimize extraneous words). EAL AU1.4 is N/A for BVPS-1 because the plant is not equipped with a perimeter radiation monitoring system. EAL AU1.5 is N/A for BVPS-1 because the plant is not equipped with a automatic real-time dose assessment system. **Rev 5 Deviations** None
AA2 **Initiating Condition - ALERT** Damage to irradiated fuel or loss of water level that has resulted or will result in the uncovering of irradiated fuel outside the reactor vessel. **Operating Mode Applicability**: All **Example Emergency Action Level:** (1 or 2) 1. A water level drop in the reactor refueling cavity, spent fuel pool or fuel transfer canal that will result in irradiated fuel becoming uncovered. 2. A VALID alarm or (site specific elevated reading) on **ANY** of the following due to damage to irradiated fuel or loss of water level. (site-specific radiation monitors)	**RA2** **INITIATING CONDITION:** Damage to irradiated fuel or loss of water level that has resulted or will result in the uncovering of irradiated fuel outside the reactor vessel. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. A water level drop in the spent fuel pool, transfer canal or cavity that will result in irradiated fuel becoming uncovered. **OR** 2. **> 1000 mR/hr** on **ANY** of the following due to damage to irradiated fuel or loss of water level: • Manipulator Crane Area Monitor (RM-1RM-203) • Fuel Pool Bridge Area Monitor (RM-1RM-207)	**Rev 5 Differences** Removed the words "reading" for human factors considerations (minimize extraneous words). Removed "VALID" in accordance with NEI 99-01 Rev 5, FAQ# 4. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
AU2 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** UNPLANNED rise in plant radiation levels. **Operating Mode Applicability**: All **Example Emergency Action Level:** (1 or 2) 1. a. UNPLANNED water level drop in a reactor refueling pathway as indicated by (site specific level or indication). **AND** b. VALID Area Radiation Monitor reading rise on (site specific list). 2. UNPLANNED VALID Area Radiation Monitor readings or survey results indicate a rise by a factor of 1000 over normal* levels. * Normal levels can be considered as the highest reading in the past twenty-four hours excluding the current peak value.	**RU2** **INITIATING CONDITION:** UNPLANNED rise in plant radiation levels. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. a. UNPLANNED water level drop in the spent fuel pool, transfer canal or reactor cavity as indicated by level **< Tech Spec Minimum (23 feet)**. **AND** b. Area radiation monitor rise resulting in a High-High alarm on **ANY** of the following: • Manipulator Crane Area Monitor (RM-1RM-203) • Fuel Pool Bridge Area Monitor (RM-1RM-207) **OR** 2. UNPLANNED area radiation monitor or radiation survey **> 1000 times NORMAL LEVELS**.	**Rev 5 Differences** Specified components of "reactor refueling pathway" in accordance with NEI 99-01 Rev 5, FAQ# 6. Removed "VALID" in accordance with NEI 99-01 Rev 5, FAQ# 4. Established "NORMAL LEVELS" as a defined term in accordance with NEI 99-01 Rev 5, FAQ# 5. Removed the words "reading" and "indicate" for human factors considerations (minimize extraneous words). **Rev 5 Deviations** Specified that EAL threshold 1.b rise in the radiation monitor reading results in an alarm.
AA3 **Initiating Condition - ALERT** Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions. **Operating Mode Applicability**: All **Example Emergency Action Level:** (1 or 2) Dose rate greater than 15 mR/hr in **ANY** of the following areas requiring continuous occupancy to maintain plant safety functions: (site specific area list)	**RA3** **INITIATING CONDITION:** Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. Dose rate **> 15 mR/hr** in **ANY** of the following areas requiring continuous occupancy to maintain plant safety functions: • CONTROL ROOM • Central Alarm Station • Secondary Alarm Station	**Rev 5 Differences** None **Rev 5 Deviations** None
Hazards and Other Conditions Affecting Plant Safety		
HG1 **Initiating Condition - GENERAL EMERGENCY** HOSTILE ACTION resulting in loss of physical control of the facility. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2) 1. A HOSTILE ACTION has occurred such that plant personnel are unable to operate equipment required to maintain safety functions. 2. A HOSTILE ACTION has caused failure of Spent Fuel Cooling Systems and IMMINENT fuel damage is likely for a freshly off-loaded reactor core in pool.	**HG1** **INITIATING CONDITION:** HOSTILE ACTION resulting in loss of physical control of the facility. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. A HOSTILE ACTION has occurred such that plant personnel are unable to operate equipment required to maintain safety functions listed below: • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink) **OR** 2. A HOSTILE ACTION has caused failure of spent fuel cooling systems and IMMINENT fuel damage is likely.	**Rev 5 Differences** Created a generalized list of the safety functions in HG1.1 (brought forward from basis). Removed "for a freshly off-loaded reactor core in pool" in accordance with NEI 99-01 Rev 5, FAQ# 29. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
HS4 **Initiating Condition - SITE AREA EMERGENCY** HOSTILE ACTION within the PROTECTED AREA. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the (site security shift supervision).	**HS1** **INITIATING CONDITION:** HOSTILE ACTION within the PROTECTED AREA. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the Security Shift Supervisor.	**Rev 5 Differences** None **Rev 5 Deviations** None
HA4 **Initiating Condition - ALERT** HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2) 1. A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the (site specific security shift supervision). 2. A validated notification from NRC of an airliner attack threat within 30 minutes of the site.	**HA1** **INITIATING CONDITION:** HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the Security Shift Supervisor. **OR** 2. A validated notification from the NRC of a LARGE AIRCRAFT attack threat within **30 minutes** of the site.	**Rev 5 Differences** Changed airliner to "LARGE AIRCRAFT" in accordance with NEI 99-01 Rev 5 FAQ# 26. **Rev 5 Deviations** None
HU4 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3) 1. A SECURITY CONDITION that does NOT involve a HOSTILE ACTION as reported by the (site specific security shift supervision). 2. A credible site specific security threat notification. 3. A validated notification from NRC providing information of an aircraft threat.	**HU1** **INITIATING CONDITION:** Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. A SECURITY CONDITION that does not involve a HOSTILE ACTION as reported by the Security Shift Supervisor. **OR** 2. A credible site specific security threat notification. **OR** 3. A validated notification from the NRC providing information of a LARGE AIRCRAFT threat.	**Rev 5 Differences** Changed aircraft to "LARGE AIRCRAFT" in accordance with NEI 99-01 Rev 5 FAQ# 26. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
<u>HS2</u> **Initiating Condition - SITE AREA EMERGENCY** Control room evacuation has been initiated and plant control cannot be established. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. a. Control room evacuation has been initiated. **AND** b. Control of the plant cannot be established within (site specific minutes).	<u>HS2</u> **INITIATING CONDITION:** CONTROL ROOM evacuation has been initiated and plant control cannot be established. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. a. CONTROL ROOM evacuation has been initiated. **AND** b. Control of **ANY** of the following safety functions is not established from an alternate location within **15 minutes**. • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink)	<u>**Rev 5 Differences**</u> Created a generalized list of safety functions in the Basis of HG1.1 (brought forward from basis). <u>**Rev 5 Deviations**</u> None
<u>HA5</u> **Initiating Condition - ALERT** Control room evacuation has been initiated. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. (Site-specific procedure) requires control room evacuation.	<u>HA2</u> **INITIATING CONDITION:** CONTROL ROOM evacuation has been initiated. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. CONTROL ROOM evacuation has been initiated.	<u>**Rev 5 Differences**</u> Removed reference to a site specific procedure in accordance with NEI 99-01 Rev 5, FAQ# 28. <u>**Rev 5 Deviations**</u> None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
HA1 **Initiating Condition - ALERT** Natural or destructive phenomena affecting VITAL AREAS. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3 or 4 or 5 or 6) 1. a. Seismic event greater than Operating Basis Earthquake (OBE) as indicated by (site specific seismic instrumentation) reading (site specific OBE limit). **AND** b. Earthquake confirmed by **ANY** of the following: • Earthquake felt in plant • National Earthquake Center • Control Room indication of degraded performance of systems required for the safe shutdown of the plant. 2. Tornado striking or high winds greater than (site specific mph) resulting in VISIBLE DAMAGE to **ANY** of the following structures containing safety systems or components **OR** control room indication of degraded performance of those safety systems: (site specific structure list) 3. Internal flooding in **ANY** of the following areas resulting in an electrical shock hazard that precludes access to operate or monitor safety equipment **OR** control room indication of degraded performance of those safety systems: (site specific area list) 4. Turbine failure-generated PROJECTILES resulting in VISIBLE DAMAGE to or penetration of **ANY** of the following structures containing safety systems or components **OR** control room indication of degraded performance of those safety systems: (site specific structure list) 5. Vehicle crash resulting in VISIBLE DAMAGE to **ANY** of the following structures containing safety systems or components **OR** control room indication of degraded performance of those safety systems: (site specific structure list) 6. (Site specific occurrences) resulting in VISIBLE DAMAGE to **ANY** of the following structures containing safety systems or components **OR** control room indication of degraded performance of those safety systems: (site specific structure list)	**HA3** **INITIATING CONDITION:** Natural or destructive phenomena affecting VITAL AREAS. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. a. Seismic event **> 0.06g (OBE)** acceleration (as indicated by analysis of the **Accelerograph Recording System** or lit lamp on 2ERS-CCC-1 Seismic Instrumentation Central Control Cabinet). **AND** b. Earthquake confirmed by **ANY** of the following: • Earthquake felt in plant. • National Earthquake Center. • CONTROL ROOM indication of degraded performance of systems required for the safe shutdown of the plant. **OR** 2. Tornado or high winds **> 80 mph** resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems. **OR** 3. Internal flooding in **Table H-1** areas resulting in **EITHER** of the following: • Electrical shock hazard that precludes access to operate or monitor safety equipment. • CONTROL ROOM indication of degraded performance of those safety systems. **OR** 4. High river water level **> 705 feet MSL** resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems. **OR** 5. Low river level (LR-1CW-101) **< 650 feet MSL** resulting in CONTROL ROOM indication of degraded performance of safety systems located in **Table H-1** areas. **OR** 6. Turbine failure-generated PROJECTILES resulting in **EITHER** of the following: • VISIBLE DAMAGE to or penetration of **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems. **OR** 7. Vehicle crash resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems.	**Rev 5 Differences** Removed HA3.2 tornado "striking" as it is irrelevant whether it strikes or not if it causes VISIBLE DAMAGE to structures containing safety systems or components. Altered the EAL sequence to allow for site specific external flooding EAL to follow internal flooding EAL (human factors). **Rev 5 Deviations** None **Table** **Table H-1** • Cable Tunnel (CV-3) • CONTROL ROOM • Containment Building • Demin. Water Storage Tank (1WT-TK-10) • Diesel Generator Building • Fuel Building • Intake Structure Pump Cubicles • Safeguards (including AFW, Main Steam and Cable Vault Areas) • Primary Auxiliary Building (except elev. 768') • RWST (1QS-TK-1) • Service Building (below elev. 735')

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
<u>HU1</u> **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Natural or destructive phenomena affecting the PROTECTED AREA. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3 or 4 or 5) 1. Seismic event identified by **ANY** 2 of the following: • Seismic event confirmed by (site specific indication or method) • Earthquake felt in plant • National Earthquake Center 2. Tornado striking within the PROTECTED AREA boundary or high winds greater than (site specific mph). 3. Internal flooding that has the potential to affect safety related equipment required by Technical Specifications for the current operating mode in **ANY** of the following areas: (site specific area list) 4. Turbine failure resulting in casing penetration or damage to turbine or generator seals. 5. (Site specific occurrences affecting PROTECTED AREA).	<u>HU3</u> **INITIATING CONDITION:** Natural or destructive phenomena affecting the PROTECTED AREA. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. a. Seismic event as indicated by **> 0.01g** acceleration (initiation of the **Accelerograph Recording System** on A11-59, Seismic Accelerograph Operation). **AND** b. Earthquake confirmed by **EITHER** of the following: • Earthquake felt in plant. • National Earthquake Center. **OR** 2. a. Tornado within the PROTECTED AREA. **OR** b. High winds **> 80 mph**. **OR** 3. Internal flooding in **Table H-1** areas that has the potential to affect safety related equipment required by Technical Specifications for the current operating mode. **OR** 4. High river water level **> 705 feet MSL**. **OR** 5. Low river water level (LR-1CW-101) **< 650 feet MSL**. **OR** 6. Turbine failure resulting in casing penetration or damage to turbine or generator seals.	<u>**Rev 5 Differences**</u> Nested HU3.1 to match HA3.1. NEI wording was established to accommodate plants that were not capable of measuring ground motion at the UE level. BVPS-1 is capable of such monitoring. Removed HU3.2 tornado "striking" as it is irrelevant whether it strikes within the PROTECTED AREA if the tornado itself is within the PROTECTED AREA. Altered the EAL sequence to allow for site specific external flooding EAL to follow internal flooding EAL (human factors). <u>**Rev 5 Deviations**</u> None <u>**Table**</u> **Table H-1** • Cable Tunnel (CV-3) • CONTROL ROOM • Containment Building • Demin. Water Storage Tank (1WT-TK-10) • Diesel Generator Building • Fuel Building • Intake Structure Pump Cubicles • Safeguards (including AFW, Main Steam and Cable Vault Areas) • Primary Auxiliary Building (except elev. 768') • RWST (1QS-TK-1) • Service Building (below elev. 735')

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
<u>HA2</u> **Initiating Condition - ALERT** FIRE or EXPLOSION affecting the operability of plant safety systems required to establish or maintain safe shutdown. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. FIRE or EXPLOSION resulting in VISIBLE DAMAGE to **ANY** of the following structures containing safety systems or components **OR** control room indication of degraded performance of those safety systems: (site specific structure list)	<u>HA4</u> **INITIATING CONDITION:** FIRE or EXPLOSION affecting the operability of plant safety systems required to establish or maintain safe shutdown. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. FIRE or EXPLOSION resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems.	<u>**Rev 5 Differences**</u> None <u>**Rev 5 Deviations**</u> None <u>**Table**</u> **Table H-1** • Cable Tunnel (CV-3) • CONTROL ROOM • Containment Building • Demin. Water Storage Tank (1WT-TK-10) • Diesel Generator Building • Fuel Building • Intake Structure Pump Cubicles • Safeguards (including AFW, Main Steam and Cable Vault Areas) • Primary Auxiliary Building (except elev. 768') • RWST (1QS-TK-1) • Service Building (below elev. 735')

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<u>HU2</u>

Initiating Condition - NOTIFICATION OF UNUSUAL EVENT

FIRE within the PROTECTED AREA not extinguished within 15 minutes of detection or EXPLOSION within the PROTECTED AREA.

Operating Mode Applicability: All

Example Emergency Action Level: (1 or 2)

Note: The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the duration has exceeded, or will likely exceed, the applicable time.

1. FIRE not extinguished within 15 minutes of control room notification or verification of a control room FIRE alarm in ANY of the following areas:

(site specific area list)

2. EXPLOSION within the PROTECTED AREA.
</td><td>
<u>HU4</u>

INITIATING CONDITION:

FIRE within the PROTECTED AREA not extinguished within 15 minutes of detection or EXPLOSION within the PROTECTED AREA.

Operating Mode Applicability: 1, 2, 3, 4, 5, 6, D

EALs:

<u>Notes:</u>
• The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the duration has exceeded, or will likely exceed, the applicable time.
• Immediately adjacent to applies to FIRES that directly impact or obstruct the areas of concern.

1. FIRE not extinguished within 15 minutes of CONTROL ROOM notification or verification of a CONTROL ROOM FIRE alarm in actual contact with or immediately adjacent to ANY of the Table H-1 areas.

OR

2. EXPLOSION within the PROTECTED AREA.
</td><td>
<u>Rev 5 Differences</u>

Added Note "in actual contact with or immediately adjacent to" from the Basis section of HU4.1 to support the use of table H-1.

<u>Rev 5 Deviations</u>

None

<u>Table</u>

Table H-1
• Cable Tunnel (CV-3)
• CONTROL ROOM
• Containment Building
• Demin. Water Storage Tank (1WT-TK-10)
• Diesel Generator Building
• Fuel Building
• Intake Structure Pump Cubicles
• Safeguards (including AFW, Main Steam and Cable Vault Areas)
• Primary Auxiliary Building (except elev. 768')
• RWST (1QS-TK-1)
• Service Building (below elev. 735')
</td></tr>
</table>

<table>
<tr><th>NEI 99-01 Rev. 5</th><th>BVPS-1 EALs</th><th>Difference or Deviation</th></tr>
<tr><td><u>HA3</u>
Initiating Condition - ALERT
Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of operable equipment required to maintain safe operations or safely shutdown the reactor.
Operating Mode Applicability: All
Example Emergency Action Level:
Note: If the equipment in the stated area was already inoperable, or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event.
1. Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of systems required to maintain safe operations or safely shutdown the reactor.</td><td><u>HA5</u>
INITIATING CONDITION:
Access to a VITAL AREA is prohibited due to release of toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of operable equipment required to maintain safe operations or safely shutdown the reactor.
Operating Mode Applicability: 1, 2, 3, 4, 5, 6, D
EALs:
<u>Notes:</u>
• If the equipment in the stated area was already inoperable, or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event.
• This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area.
1. Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of systems required to maintain safe operations or safely shutdown the reactor.</td><td><u>Rev 5 Differences</u>
Added generic bases information regarding applicability per NEI 99-01 Rev 5, FAQ# 24 and brought forward in to notes.
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td><u>HU3</u>
Initiating Condition - NOTIFICATION OF UNUSUAL EVENT
Release of toxic, corrosive, asphyxiant or flammable gases deemed detrimental to NORMAL PLANT OPERATIONS.
Operating Mode Applicability: All
Example Emergency Action Level: (1 or 2)
1. Toxic, corrosive, asphyxiant or flammable gases in amounts that have or could adversely affect NORMAL PLANT OPERATIONS.
2. Report by local, county or state officials for evacuation or sheltering of site personnel based on an off-site event.</td><td><u>HU5</u>
INITIATING CONDITION:
Release of toxic, corrosive, asphyxiant or flammable gases deemed detrimental to NORMAL PLANT OPERATIONS.
Operating Mode Applicability: 1, 2, 3, 4, 5, 6, D
EALs:
Note: This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area.
1. Toxic, corrosive, asphyxiant or flammable gases in amounts that have or could adversely affect NORMAL PLANT OPERATIONS.
OR
2. Report by local, county or state officials for evacuation or sheltering of site personnel based on an OFFSITE event.</td><td><u>Rev 5 Differences</u>
Added generic bases information regarding applicability per NEI 99-01 Rev 5, FAQ# 24 and pulled in to notes.
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td><u>HG2</u>
Initiating Condition - GENERAL EMERGENCY
Other conditions exist which in the judgment of the Emergency Director warrant declaration of a General Emergency.
Operating Mode Applicability: All
Example Emergency Action Level:
1. Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA Protective Action Guideline exposure levels off-site for more than the immediate site area.</td><td><u>HG6</u>
INITIATING CONDITION:
Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of GENERAL EMERGENCY.
Operating Mode Applicability: 1, 2, 3, 4, 5, 6, D
EALs:
1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PROTECTIVE ACTION GUIDE exposure levels OFFSITE for more than the immediate site area.</td><td><u>Rev 5 Differences</u>
None
<u>Rev 5 Deviations</u>
None</td></tr>
</table>

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
HS3 **Initiating Condition - SITE AREA EMERGENCY** Other conditions exist which in the judgment of the Emergency Director warrant declaration of a Site Area Emergency. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts; (1) toward site personnel or equipment that could lead to the likely failure of or; (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA Protective Action Guideline exposure levels beyond the site boundary.	**HS6** **INITIATING CONDITION:** Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of SITE AREA EMERGENCY. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts: (1) toward site personnel or equipment that could lead to the likely failure of or, (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PROTECTIVE ACTION GUIDE exposure levels beyond the site boundary.	**Rev 5 Differences** None **Rev 5 Deviations** None
HA6 **Initiating Condition - ALERT** Other conditions exist which in the judgment of the Emergency Director warrant declaration of an Alert. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which involve actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA Protective Action Guideline exposure levels.	**HA6** **INITIATING CONDITION:** Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an ALERT. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA PROTECTIVE ACTION GUIDE exposure levels.	**Rev 5 Differences** None **Rev 5 Deviations** None
HU5 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Other conditions exist which in the judgment of the Emergency Director warrant declaration of a NOUE. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring off-site response or monitoring are expected unless further degradation of safety systems occurs.	**HU6** **INITIATING CONDITION:** Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an UNUSUAL EVENT. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring OFFSITE response or monitoring are expected unless further degradation of safety systems occurs.	**Rev 5 Differences** None **Rev 5 Deviations** None

<table>
<tr><th>NEI 99-01 Rev. 5</th><th>BVPS-1 EALs</th><th>Difference or Deviation</th></tr>
<tr><td><u>E-HU1</u>
Initiating Condition - NOTIFICATION OF UNUSUAL EVENT
Damage to a loaded cask CONFINEMENT BOUNDARY.
Operating Mode Applicability: Not applicable
Example Emergency Action Level:
1. Damage to a loaded cask CONFINEMENT BOUNDARY.</td><td><u>E-HU1</u>
INITIATING CONDITION:
Damage to a loaded cask CONFINEMENT BOUNDARY.
Operating Mode Applicability: Not Applicable
EALs:
1. Damage to a loaded cask CONFINEMENT BOUNDARY.</td><td><u>Rev 5 Differences</u>
None
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td colspan="3">System Malfunctions - Hot</td></tr>
<tr><td><u>SG1</u>
Initiating Condition - GENERAL EMERGENCY
Prolonged loss of all Off-site and all On-Site AC power to emergency busses.
Operating Mode Applicability: Power Operation, Startup, Hot Standby, Hot Shutdown
Example Emergency Action Level:
1. a. Loss of all off-site and on-site AC power to (site specific emergency busses).
AND
b. EITHER of the following:
• Restoration of at least one emergency bus in less than (site specific hours) is not likely.
• (Site specific Indication of continuing degradation of core cooling based on Fission Product Barrier monitoring.)</td><td><u>SG1</u>
INITIATING CONDITION:
Prolonged loss of all OFFSITE and all ONSITE AC power to emergency busses.
Operating Mode Applicability: 1, 2, 3, 4
EALs:
1. a. Loss of ALL OFFSITE and ALL ONSITE AC power to BOTH AE and DF 4KV emergency busses.
AND
b. EITHER of the following:
• Restoration of EITHER the AE 4KV emergency bus OR DF 4KV emergency bus within 4 hours is not likely.
• Core Cooling - Red entry conditions met.</td><td><u>Rev 5 Differences</u>
None
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td><u>SS1</u>
Initiating Condition - SITE AREA EMERGENCY
Loss of all Off-site and all On-Site AC power to emergency busses for 15 minutes or longer.
Operating Mode Applicability: Power Operation, Startup, Hot Standby, Hot Shutdown
Example Emergency Action Level:
Note: The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.
1. Loss of all Off-Site and all On-Site AC power to (site specific emergency busses) for 15 minutes or longer.</td><td><u>SS1</u>
INITIATING CONDITION:
Loss of all OFFSITE and all ONSITE AC power to emergency busses for 15 minutes or longer.
Operating Mode Applicability: 1, 2, 3, 4
EALs:
<u>Notes:</u>
• The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.
• Credit cannot be taken for emergency busses being powered from the other unit's emergency diesel generators.
1. Loss of ALL OFFSITE and ALL ONSITE AC power to BOTH AE and DF 4KV emergency busses for 15 minutes or longer.</td><td><u>Rev 5 Differences</u>
Added Note from bases section to ensure the cross-tie was not credited as a source of OFFSITE power.
<u>Rev 5 Deviations</u>
None</td></tr>
</table>

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
SA5 **Initiating Condition - ALERT** AC power capability to emergency busses reduced to a single power source for 15 minutes or longer such that any additional single failure would result in station blackout. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. a. AC power capability to (site-specific emergency busses) reduced to a single power source for 15 minutes or longer. **AND** b. Any additional single power source failure will result in station blackout.	**SA1** **INITIATING CONDITION:** AC power capability to emergency busses reduced to a single source for 15 minutes or longer. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. a. AC power to AE and DF 4KV emergency busses is reduced to a single power source for **15 minutes** or longer. **AND** b. Any additional single power source failure will result in loss of **ALL** AC power to **BOTH** AE and DF 4KV emergency busses.	**Rev 5 Differences** Changed IC and EAL terminology for consistency in accordance with NEI 99-01 Rev 5, FAQ# 36. **Rev 5 Deviations** None
SU1 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Loss of all Off-site AC power to emergency busses for 15 minutes or longer. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. Loss of all off-site AC power to (site-specific emergency busses) for 15 minutes or longer.	**SU1** **INITIATING CONDITION:** Loss of all OFFSITE AC power to emergency busses for 15 minutes or longer. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. Loss of **ALL** OFFSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes** or longer.	**Rev 5 Differences** None **Rev 5 Deviations** None
SS3 **Initiating Condition - SITE AREA EMERGENCY** Loss of all vital DC power for 15 minutes or longer. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. Less than (site specific bus voltage indication) on all (site specific Vital DC busses) for 15 minutes or longer.	**SS2** **INITIATING CONDITION:** Loss of all vital DC power for 15 minutes or longer. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. Bus voltage indication on **ALL** safety related DC busses less than the following for **15 minutes** or longer: • **< 110.4 VDC** on Busses 1-1 and 1-2 • **< 110.0 VDC** on Busses 1-3 and 1-4	**Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
SG2 **Initiating Condition - GENERAL EMERGENCY** Automatic Scram (Trip) and all manual actions fail to shutdown the reactor and indication of an extreme challenge to the ability to cool the core exists. **Operating Mode Applicability:** *Power Operation, Startup* **Example Emergency Action Level:** 1. a. An automatic scram (trip) failed to shutdown the reactor. **AND** b. All manual actions do not shutdown the reactor as indicated by (site specific indications of reactor not shutdown). **AND** c. **EITHER** of the following exist or have occurred due to continued power generation: • (Site specific indication that core cooling is extremely challenged.) • (Site specific indication that heat removal is extremely challenged.)	**SG3** **INITIATING CONDITION:** Automatic trip and all manual actions failed to shutdown the reactor and indication of an extreme challenge to the ability to cool the core exists. **Operating Mode Applicability:** 1, 2 **EALs:** 1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power > 5%. **AND** b. **ALL** manual trip actions failed to shutdown the reactor as indicated by reactor power > 5%. **AND** c. **EITHER** of the following has occurred: • Core Cooling - Red entry conditions met. • Heat Sink - Red entry conditions met.	**Rev 5 Differences** Changed IC and EAL terminology for consistency in accordance with NEI 99-01 Rev 5, FAQ# 31. Removed the SG3.1.c words "exist or" for human factors considerations (minimize extraneous words). Revised tense in EAL 1.b to reflect consistency with wording in EAL 1.a. **Rev 5 Deviations** None
SS2 **Initiating Condition - SITE AREA EMERGENCY** Automatic Scram (Trip) fails to shutdown the reactor and manual actions taken from the reactor control console are not successful in shutting down the reactor. **Operating Mode Applicability:** Power Operation, Startup **Example Emergency Action Level:** 1. a. An automatic scram (trip) failed to shutdown the reactor. **AND** b. Manual actions taken at the reactor control console do not shutdown the reactor as indicated by (site specific indications of reactor not shutdown).	**SS3** **INITIATING CONDITION:** Automatic trip and manual actions taken within the Controls Area (CA) failed to shutdown the reactor. **Operating Mode Applicability:** 1, 2 **EALs:** 1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power > 5%. **AND** b. Manual trip actions taken within the Controls Area (CA) failed to shutdown the reactor as indicated by reactor power > 5%.	**Rev 5 Differences** IC and EAL wording changed from "from the reactor controls console" to "within the Controls Area (CA)" to be consistent with site specific terminology. Changed IC and EAL terminology for consistency in accordance with NEI 99-01 Rev 5, FAQ# 31. Also specified manual "trip" actions to distinguish from emergency boration actions. **Rev 5 Deviations** None
SA2 **Initiating Condition - ALERT** Automatic Scram (Trip) fails to shutdown the reactor and the manual actions taken from the reactor control console are successful in shutting down the reactor. **Operating Mode Applicability:** Power Operation, Startup **Example Emergency Action Level:** 1. a. An automatic scram (trip) failed to shutdown the reactor. **AND** b. Manual actions taken at the reactor control console successfully shutdown the reactor as indicated by (site specific indications of plant shutdown).	**SA3** **INITIATING CONDITION:** Automatic trip failed to shutdown the reactor and the manual actions taken from the Controls Area (CA) are successful in shutting down the reactor. **Operating Mode Applicability:** 1, 2 **EALs:** 1. a. An automatic reactor trip failed to shutdown the reactor. **AND** b. Manual trip actions taken within the Controls Area (CA) successfully shutdown the reactor as indicated by reactor power ≤ 5%.	**Rev 5 Differences** IC and EAL wording changed from "from the reactor controls console" to "within the Controls Area (CA)" to be consistent with site specific terminology. Changed IC and EAL terminology for consistency in accordance with NEI 99-01 Rev 5, FAQ# 31. Also specified manual "trip" actions to distinguish from emergency boration actions. **Rev 5 Deviations** None

<table>
<tr><th>NEI 99-01 Rev. 5</th><th>BVPS-1 EALs</th><th>Difference or Deviation</th></tr>
<tr><td>
<u>SU8</u>
Initiating Condition - NOTIFICATION OF UNUSUAL EVENT
Inadvertent Criticality.
Operating Mode Applicability: Hot Standby, Hot Shutdown
Example Emergency Action Level:
1. UNPLANNED sustained positive period observed on nuclear instrumentation. [BWR]
1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation. [PWR]
</td><td>
<u>SU3</u>
INITIATING CONDITION:
Inadvertent criticality.
Operating Mode Applicability: 3, 4
EALs:
1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.
</td><td>
<u>Rev 5 Differences</u>
None
<u>Rev 5 Deviations</u>
None
</td></tr>
<tr><td>
<u>SS6</u>
Initiating Condition - SITE AREA EMERGENCY
Inability to monitor a SIGNIFICANT TRANSIENT in progress.
Operating Mode Applicability: Power Operation, Startup, Hot Standby, Hot Shutdown
Example Emergency Action Level:
Note: The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.
1. a. Loss of greater than approximately 75% of the following for 15 minutes or longer:
• (Site specific control room safety system annunciation)
OR
• (Site specific control room safety system indication)
AND
b. A SIGNIFICANT TRANSIENT is in progress.
AND
c. Compensatory indications are unavailable.
</td><td>
<u>SS4</u>
INITIATING CONDITION:
Inability to monitor a significant transient in progress.
Operating Mode Applicability: 1, 2, 3, 4
EALs:
Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.
1. a. Loss of > 75% of EITHER of the following for 15 minutes or longer:
• CONTROL ROOM Annunciator Panels (A1 - A13).
OR
• CONTROL ROOM critical safety function indications (Table S-1).
Table S-1: Critical Safety Functions
• Reactivity Control (ability to shut down the reactor and keep it shut down)
• RCS inventory (ability to cool the core)
• Secondary heat removal (ability to maintain a heat sink)
AND
b. A Table S-2 significant transient is in progress.
Table S-2: Significant Transients
• Automatic turbine runback > 25% thermal power
• Electrical load rejection > 25% full electrical load
• Reactor trip
• Safety Injection actuation
AND
c. COMPENSATORY INDICATIONS are unavailable.
</td><td>
<u>Rev 5 Differences</u>
Eliminated "SIGNIFICANT TRANSIENT" as a defined term in accordance with NEI 99-01 Rev 5, FAQ# 39.
Created a generalized list of safety functions in the basis of HG1.1 (brought forward from basis).
Removed "approximately" in SS4.1.a to eliminate ambiguity.
<u>Rev 5 Deviations</u>
None
</td></tr>
</table>

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
SA4 **Initiating Condition - ALERT** UNPLANNED Loss of safety system annunciation or indication in the control room with EITHER (1) a SIGNIFICANT TRANSIENT in progress, or (2) compensatory indicators unavailable. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. a. UNPLANNED Loss of greater than approximately 75% of the following for 15 minutes or longer: • (Site specific control room safety system annunciation) **OR** • (Site specific control room safety system indication) b. **EITHER** of the following: • A SIGNIFICANT TRANSIENT is in progress. • Compensatory indications are unavailable.	**SA4** **INITIATING CONDITION:** Loss of safety system annunciation or indication in the CONTROL ROOM with either: (1) a significant transient in progress, or (2) COMPENSATORY INDICATIONS are unavailable. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. a. Loss of **> 75%** of **EITHER** of the following for **15 minutes** or longer: • CONTROL ROOM Annunciator Panels (A1 - A13). **OR** • CONTROL ROOM critical safety function indications (Table S-1). **Table S-1: Critical Safety Functions** • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink) **AND** b. **EITHER** of the following: • A **Table S-2** significant transient is in progress. **Table S-2: Significant Transients** • Automatic turbine runback > 25% thermal power • Electrical load rejection > 25% full electrical load • Reactor trip • Safety Injection actuation **OR** • COMPENSATORY INDICATIONS are unavailable.	**Rev 5 Differences** Changed significant transient criteria in accordance with NEI 99-01 Rev 5, FAQ# 39. Removed "approximately" in SA4.1.a to eliminate ambiguity. Created a generalized list of safety functions in the basis of HG1.1 (brought forward from basis). Removed "UNPLANNED" from the IC and EAL to be consistent with SS4 (NEI SS6). Plant operations do not allow for the planned removal of > 75% of safety system annunciation and indication while in the hot modes. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
SU3 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** UNPLANNED loss of safety system annunciation or indication in the control room for 15 minutes or longer. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. UNPLANNED loss of greater than approximately 75% of the following for 15 minutes or longer: a. (Site specific control room safety system annunciation) **OR** b. (Site specific control room safety system indication)	**SU4** **INITIATING CONDITION:** Loss of safety system annunciation or indication in the CONTROL ROOM for 15 minutes or longer. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. Loss of **> 75%** of **EITHER** the following for **15 minutes** or longer: • CONTROL ROOM Annunciator Panels (A1 - A13). **OR** • CONTROL ROOM critical safety function indications (Table S-1). **Table S-1: Critical Safety Functions** • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink)	**Rev 5 Differences** Removed "approximately" in SU4.1 to eliminate ambiguity. Created a generalized list of safety functions in the basis of HG1.1 (brought forward from basis). Removed "UNPLANNED" from the IC and EAL to be consistent with SS4 (NEI SS6). Plant operations do not allow for the planned removal of > 75% of safety system annunciation and indication while in the hot modes. **Rev 5 Deviations** None
SU2 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Inability to reach required shutdown within Technical Specification limits. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** 1. Plant is not brought to required operating mode within Technical Specifications LCO Action Statement Time.	**SU5** **INITIATING CONDITION:** Inability to reach required operating mode within Technical Specification limits. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** 1. Plant is not brought to required operating mode within Technical Specification LCO action statement time.	**Rev 5 Differences** Changed "shutdown" to "operating mode" in the IC in accordance with NEI 99-01 Rev 5, FAQ# 30. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
SU6 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Loss of all On-site or Off-site communications capabilities. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** (1 or 2) 1. Loss of all of the following on-site communication methods affecting the ability to perform routine operations. (site specific list of communications methods) 2. Loss of all of the following off-site communication methods affecting the ability to perform offsite notifications. (site specific list of communications methods)	**SU6** **INITIATING CONDITION:** Loss of all ONSITE or OFFSITE communications capabilities. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** 1. Loss of **ALL** of the following ONSITE communication methods affecting the ability to perform routine operations: • Radios. • Plant page. • Plant telephone System (hardwired). **OR** 2. Loss of **ALL** of the following OFFSITE communications methods affecting the ability to perform OFFSITE notifications: • NRC Emergency Notification System – ENS (Red Phone). • NRC Health Physics Network – HPN. • Commercial telephones (hardwired and wireless).	**Rev 5 Differences** None **Rev 5 Deviations** None
SU5 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** RCS leakage. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** (1 or 2) 1. Unidentified or pressure boundary leakage greater than 10 gpm. 2. Identified leakage greater than 25 gpm.	**SU7** **INITIATING CONDITION:** RCS leakage. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Note:** • Identified, unidentified and pressure boundary RCS leakage as defined by Technical Specifications. • Relief valve normal operation should be excluded unless it fails to close and cannot be isolated. 1. Unidentified or pressure boundary leakage **> 10 gpm.** **OR** 2. Identified leakage **> 25 gpm.**	**Rev 5 Differences** Added information to the site specific basis section and a note to the EAL section to specify that the leakage terms were formally defined by Technical Specifications. Added information for relief valve operation from the SU7 (NEI SU5) generic basis to a Note into the EAL. **Rev 5 Deviations** None
SU4 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Fuel Clad degradation. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** (1 or 2) 1. (Site specific radiation monitor readings indicating fuel clad degradation greater than Technical Specification allowable limits.) 2. (Site specific coolant sample activity value indicating fuel clad degradation greater than Technical Specification allowable limits.)	**SU9** **INITIATING CONDITION:** Fuel clad degradation. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** 1. Letdown Monitor (RM-CH-101A or B) **> 6.0E+04 cpm.** **OR** 2. RCS activity **> 21 μCi/gm** dose equivalent I-131.	**Note:** Monitor range is 1E+1 to 1E+6 cpm. **Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
System Malfunctions - Cold		
CA3 **Initiating Condition - ALERT** Loss of all Off-site and all On-Site AC power to emergency busses for 15 minutes or longer. **Operating Mode Applicability:** Cold Shutdown, Refueling, Defueled **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. Loss of all Off-Site and On-Site AC Power to (site specific emergency busses) for 15 minutes or longer.	**CA1** **INITIATING CONDITION:** Loss of all OFFSITE and all ONSITE AC power to emergency busses for 15 minutes or longer. **Operating Mode Applicability:** 5, 6, D **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes** or longer.	**Rev 5 Differences** None **Rev 5 Deviations** None
CU3 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** AC power capability to emergency busses is reduced to a single power source for 15 minutes or longer such that any additional single failure would result in a station blackout. **Operating Mode Applicability:** Cold Shutdown, Refueling **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. a. AC power capability to (site specific emergency busses) reduced to a single power source for 15 minutes or longer. **AND** b. Any additional singe power source failure will result in a station blackout.	**CU1** **INITIATING CONDITION:** AC power capability to emergency busses reduced to a single source for 15 minutes or longer. **Operating Mode Applicability:** 5, 6 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. a. AC power to AE and DF 4KV emergency busses is reduced to a single power source for **15 minutes** or longer. **AND** b. Any additional single power source failure will result in loss of **ALL** AC power to **BOTH** AE and DF 4KV emergency busses.	**Rev 5 Differences** Changed IC and EAL terminology for consistency in accordance with NEI 99-01 Rev 5, FAQ# 36. **Rev 5 Deviations** None
CU7 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Loss of required DC power for 15 minutes or longer. **Operating Mode Applicability:** Cold Shutdown, Refueling **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. Less than (site specific bus voltage indication) on required (site specific Vital DC busses) for 15 minutes or longer.	**CU2** **INITIATING CONDITION:** Loss of required DC power for 15 minutes or longer. **Operating Mode Applicability:** 5, 6 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. Bus voltage indication on the **required** DC busses less than the following for **15 minutes** or longer: • **< 110.4 VDC** on Bus 1-1 or Bus 1-2 • **< 110.0 VDC** on Bus 1-3 or Bus 1-4	**Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
CU8 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Inadvertent criticality. **Operating Mode Applicability:** Cold Shutdown, Refueling **Example Emergency Action Level:** 1. UNPLANNED sustained positive period observed on nuclear instrumentation. (BWR) 1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation. (PWR)	**CU3** **INITIATING CONDITION:** Inadvertent criticality. **Operating Mode Applicability:** 5, 6 **EALs:** 1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.	**Rev 5 Differences** None **Rev 5 Deviations** None
CU6 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Loss of all On-site or Off-site communications capabilities. **Operating Mode Applicability:** Cold Shutdown, Refueling, Defueled **Example Emergency Action Level:** (1 or 2) 1. Loss of all of the following on-site communication methods affecting the ability to perform routine operations: (site specific list of communications methods) 2. Loss of all of the following off-site communication methods affecting the ability to perform offsite notifications: (site specific list of communications methods)	**CU6** **INITIATING CONDITION:** Loss of all ONSITE or OFFSITE communications capabilities. **Operating Mode Applicability:** 5, 6, D **EALs:** 1. Loss of **ALL** of the following ONSITE communication methods affecting the ability to perform routine operations: • Radios. • Plant page. • Plant telephone system (hardwired). **OR** 2. Loss of **ALL** of the following OFFSITE communications methods affecting the ability to perform OFFSITE notifications: • NRC Emergency Notification System – ENS (Red Phone). • NRC Health Physics Network – HPN. • Commercial telephones (hardwired and wireless).	**Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
<u>CG1</u> **Initiating Condition - GENERAL EMERGENCY** Loss of RCS/RPV inventory affecting fuel clad integrity with containment challenged. **Operating Mode Applicability:** Cold Shutdown, Refueling **Example Emergency Action Level:** (1 or 2) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. a. RCS/RPV level less than (site specific level for TOAF) for 30 minutes or longer. **AND** b. **ANY** containment challenge indication (see Table): 2. a. RCS/RPV level cannot be monitored with core uncovery indicated by **ANY** of the following for 30 minutes or longer. • (Site specific radiation monitor) reading greater than (site specific setpoint). • Erratic source range monitor indication • UNPLANNED level rise in (site specific sump or tank). • *[Other site specific indications]* **AND** b. **ANY** containment challenge indication (see Table): **Table: Containment Challenge Indications** • CONTAINMENT CLOSURE not established. • (Site specific explosive mixture) inside containment. • UNPLANNED rise in containment pressure. • Secondary containment radiation monitor reading above (site specific value). *[BWR only]*	<u>CG7</u> **INITIATING CONDITION:** Loss of RCS inventory affecting fuel clad integrity with containment challenged. **Operating Mode Applicability:** 5, 6 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. a. RCS level **< 56%** RVLIS Full Range (top of active fuel) for **30 minutes** or longer. **AND** b. **ANY Table C-1** containment challenge indications. **OR** 2. a. RCS level cannot be monitored with core uncovery for **30 minutes** or longer. **AND** b. Loss of RCS inventory as indicated by **ANY** of the following: • Containment Radiation Monitor (RM-1RM-219A or B) **> 15 R/hr.** • Erratic source range monitor indication. • UNPLANNED level rise in Containment sumps or incore instrument sump. **AND** c. **ANY Table C-1** containment challenge indications. **Table C-1: Containment Challenge Indications** • CONTAINMENT CLOSURE not established. • Hydrogen concentration > 4% inside containment. • UNPLANNED rise in containment pressure.	<u>**Note:**</u> Changes to the nesting format of EAL CG7.2.a is considered administrative. <u>**Rev 5 Differences**</u> Removed the word "reading" CG7.2.b bullet 1 (NEI CG1.2.a bullet 1) for human factors considerations (minimize extraneous words). <u>**Rev 5 Deviations**</u> None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
<u>**CS1**</u> **Initiating Condition - SITE AREA EMERGENCY** Loss of RCS/RPV inventory affecting core decay heat removal capability. **Operating Mode Applicability:** Cold Shutdown, Refueling **Example Emergency Action Level:** (1 or 2 or 3) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. With CONTAINMENT CLOSURE not established, RCS/RPV level less than (site specific level). *[6" below the bottom ID of the RCS loop (PWR)]* *[6" below the low-low ECCS actuation setpoint (BWR)]* **OR** 2. With CONTAINMENT CLOSURE established, RCS/RPV level less than (site specific level for TOAF). **OR** 3. RCS/RPV level cannot be monitored for 30 minutes or longer with a loss of RCS/RPV inventory as indicated by **ANY** of the following: • (Site specific radiation monitor) reading greater than (site specific value). • Erratic Source Range Monitor Indication. • Unexplained level rise in (site specific sump or tank).	<u>**CS7**</u> **INITIATING CONDITION:** Loss of RCS inventory affecting core decay heat removal capability. **Operating Mode Applicability:** 5, 6 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. a. CONTAINMENT CLOSURE not established. **AND** b. RCS level **< 64%** RVLIS Full Range (6" below bottom of hot leg). **OR** 2. a. CONTAINMENT CLOSURE established. **AND** b. RCS level **< 56%** RVLIS Full Range (top of active fuel). **OR** 3. a. RCS level cannot be monitored for **30 minutes** or longer. **AND** b. Loss of RCS inventory as indicated by **ANY** of the following: • Containment Radiation Monitor (RM-1RM-219A or B) **> 15 R/hr**. • Erratic source range monitor indication. • UNPLANNED level rise in Containment sumps or incore instrument sump.	<u>**Note:**</u> Changes to the nesting format of EALs CS7.1, CS7.2 and CS7.3 are considered administrative. <u>**Rev 5 Differences**</u> Added wording "Loss of RCS inventory as indicated by" to CS7.3.b to maintain consistency with CA7.1 wording in the escalation pathway. Replaced "unexplained" with "UNPLANNED" in accordance with NEI 99-01 Rev 5, FAQ# 10. <u>**Rev 5 Deviations**</u> None

<table>
<tr><th>NEI 99-01 Rev. 5</th><th>BVPS-1 EALs</th><th>Difference or Deviation</th></tr>
<tr><td><u>CA1</u>
Initiating Condition - ALERT
Loss of RCS/RPV inventory.
Operating Mode Applicability: Cold Shutdown, Refueling
Example Emergency Action Level: (1 or 2)
Note: The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.
1. Loss of RCS/RPV inventory as indicated by level less than (site specific level).
[Low-Low ECCS actuation setpoint / Level 2 (BWR)]
[Bottom ID of the RCS loop (PWR)]
2. RCS/RPV level cannot be monitored for 15 minutes or longer with a loss of RCS/RPV inventory as indicated by an unexplained level rise in (site specific sump or tank).</td><td><u>CA7</u>
INITIATING CONDITION:
Loss of RCS inventory.
Operating Mode Applicability: 5, 6
EALs:
Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.
1. Loss of RCS inventory as indicated by ANY of the following:
• RVLIS Full Range Level (LT-1RC-1311) < 65% (bottom of hot leg.
• Refueling Outage Temporary Level Instrument (LI-1RC-481C) < 16 inches (Reduced Inventory Only).
• Refueling Outage Temporary Level Instrument (LI-1RC-482C) < 6 inches (Midloop Only).
OR
2. a. RCS level cannot be monitored for 15 minutes or longer.
AND
b. Loss of RCS inventory as indicated by UNPLANNED level rise in Containment sumps or incore instrument sump.</td><td><u>Note:</u> Changes to the nesting format of EAL CA7.2 is considered administrative.
<u>Rev 5 Differences</u>
Replaced "unexplained" with "UNPLANNED" in accordance with NEI 99-01 Rev 5, FAQ# 10.
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td><u>CU1</u>
Initiating Condition - NOTIFICATION OF UNUSUAL EVENT
RCS leakage.
Operating Mode Applicability: Cold Shutdown
Example Emergency Action Level:
Note: The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.
1. RCS leakage results in the inability to maintain or restore RPV level greater than (site specific low level RPS actuation setpoint) for 15 minutes or longer. [BWR]
1. RCS leakage results in the inability to maintain or restore level within (site specific pressurizer or RCS/RPV level target band) for 15 minutes or longer. [PWR]</td><td><u>CU7</u>
INITIATING CONDITION:
RCS leakage.
Operating Mode Applicability: 5
EALs:
Notes:
• The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.
• Relief valve normal operation should be excluded unless it fails to close and cannot be isolated.
1. RCS leakage results in the inability to maintain or restore RCS level >Target Level Band for 15 minutes or longer.</td><td><u>Rev 5 Differences</u>
Added a description of the "Target Level Band" in the basis, which normally is the RCS level band established by site procedures.
Added information for relief valve operation from the CU7 (NEI CU1) generic basis to a Note into the EAL.
<u>Rev 5 Deviations</u>
None</td></tr>
</table>

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation
CU2 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** UNPLANNED loss of RCS/RPV inventory. **Operating Mode Applicability:** Refueling **Example Emergency Action Level:** (1 or 2) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. UNPLANNED RCS/RPV level drop as indicated by either of the following: • RCS/RPV water level drop below the RPV flange for 15 minutes or longer when the RCS/RPV level band is established above the RPV flange. • RCS/RPV water level drop below the RCS level band for 15 minutes or longer when the RCS/RPV level band is established below the RPV flange. 2. RCS/RPV level cannot be monitored with a loss of RCS/RPV inventory as indicated by an unexplained level rise in (site specific sump or tank).	**CU8** **INITIATING CONDITION:** UNPLANNED loss of RCS inventory. **Operating Mode Applicability:** 6 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. UNPLANNED RCS level drop as indicated by **EITHER** of the following: • Refueling Outage Temporary Level Instruments (L-1RC-481C) **< 97 inches** (vessel flange) for **15 minutes** or longer when the RCS level band is established **above** the vessel flange. **OR** • RCS water level drop below the RCS level band for **15 minutes** or longer when the RCS level band is established **below** the vessel flange. **OR** 2. a. RCS level cannot be monitored. **AND** b. Loss of RCS inventory as indicated by UNPLANNED level rise in Containment sumps or incore instrument sump.	**Note:** Changes to the nesting format of EAL CU8.2 is considered administrative. **Rev 5 Differences** Replaced "unexplained" with "UNPLANNED" in accordance with NEI 99-01 Rev 5, FAQ# 10. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-1 EALs	Difference or Deviation

CA4

Initiating Condition - ALERT

Inability to maintain plant in cold shutdown.

Operating Mode Applicability: Cold Shutdown, Refueling

Example Emergency Action Level: (1 or 2)

1. An UNPLANNED event results in RCS temperature greater than (site specific Technical Specification cold shutdown temperature limit) for greater than the specified duration on table.

Table: RCS Reheat Duration Thresholds		
RCS	**Containment Closure**	**Duration**
Intact (but not RCS Reduced Inventory [PWR])	N/A	60 minutes*
Not Intact or RCS Reduced Inventory (PWR)	Established	20 minutes*
	Not Established	0 minutes
* If an RCS heat removal system is in operation within this time frame ~~and RCS~~ temperature is ~~being reduced~~, the EAL is not applicable.		

2. An UNPLANNED event results in RCS pressure increase greater than 10 psi due to a loss of RCS cooling. (PWR-This EAL does not apply in Solid Plant conditions.)

CA10

INITIATING CONDITION:

Inability to maintain plant in Cold Shutdown.

Operating Mode Applicability: 5, 6

EALs:

Note: Full inventory is pressurizer level ≥ 22% actual with loop stops either isolated or unisolated.

1. RCS temperature **> 200° F** due to an UNPLANNED loss of decay heat removal capability for the greater than the specified duration on **Table C-2**.

Table C-2: RCS Reheat Duration Thresholds		
RCS	**CONTAINMENT CLOSURE**	**Duration**
Intact with Full RCS Inventory	N/A	60 minutes*
Not Intact OR Not Full RCS Inventory	Established	20 minutes*
	Not Established	0 minutes
* If an RCS heat removal system is in operation within this time frame and RCS temperature is being reduced, the EAL is not applicable.		

OR

2. a. RCS temperature cannot be monitored.

   AND

   b. RCS pressure rise **> 10 psi** due to an UNPLANNED loss of decay heat removal capability (this EAL does not apply in RCS solid plant conditions).

Rev 5 Differences

Specified the UNPLANNED event in BVPS-1 CA10.1 as being due to an UNPLANNED loss of decay heat removal capability to be consistent with NEI CU4 IC in accordance with NEI 99-01 Rev 5 FAQ#13.

Added the site specific condition for full inventory to the site specific basis section and as a note in the EAL section.

Reworded CA10.2 in accordance with NEI 99-01 Rev 5, FAQ# 13.

Reworded the first RCS entry condition in Table C-2 to be a positive statement. Reworded the second condition for consistency with the wording in the first condition. These changes are considered administrative.

Rev 5 Deviations

The conditional statement "RCS temperature cannot be monitored" was added as a condition to CA10.2. This is consistent with the basis of CA4 in the proposed NEI 99-01 Rev 6.

CU4

Initiating Condition - NOTIFICATION OF UNUSUAL EVENT

UNPLANNED loss of decay heat removal capability with irradiated fuel in the RPV.

Operating Mode Applicability: Cold Shutdown, Refueling

Example Emergency Action Level: (1 or 2)

Note: The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. UNPLANNED event results in RCS temperature exceeding the Technical Specification cold shutdown temperature limit.
2. Loss of all RCS temperature and RCS/RPV level indication for 15 minutes or longer.

CU10

INITIATING CONDITION:

UNPLANNED loss of decay heat removal capability.

Operating Mode Applicability: 5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. RCS temperature **> 200° F** due to an UNPLANNED loss of decay heat removal capability.

OR

2. Loss of **ALL** RCS temperature and RCS level indication for **15 minutes** or longer.

Rev 5 Differences

Removed "with irradiated fuel in reactor vessel" from IC in accordance with NEI 99-01 Rev 5, FAQ# 11.

Specified the UNPLANNED event in CU10.1 as being due to an UNPLANNED loss of decay heat removal capability to be consistent with NEI CU4 IC and the change to BVPS-1 CA10.2 in accordance with NEI 99-01 Rev 5 FAQ#13.

Rev 5 Deviations

None

Appendix 5
L-11-320

Beaver Valley Power Station Unit No. 2 EAL Evaluation
(Forty-Seven pages follow)

BACKGROUND AND SCOPE

The Emergency Action Level (EAL) scheme for the Beaver Valley Power Station Unit No. 2 (BVPS-2) is currently written to conform to the guidance provided in NUMARC/NESP-007, "Methodology for Development of Emergency Action Levels."

Nuclear Energy Institute (NEI) 99-01, "Methodology for Development of Emergency Action Levels," Revision 5 (ADAMS Accession No. ML080450149) was accepted for use by the NRC in a letter to NEI dated February 22, 2008. NEI submitted a series of frequently asked questions (FAQs), which clarified portions of NEI 99-01, Revision 5, to the NRC for review. By NRC memorandum dated September 17, 2010 (ADAMS Accession Nos. ML102580901 and ML102030330), the NRC stated that they performed a technical review of the FAQs and accepted the disposition of a number of the FAQs.

This revision to the Beaver Valley Power Station Unit No. 2 Emergency Plan EALs will provide a site specific version of the NEI 99-01, Revision 5 EALs, as clarified by a series of frequently asked questions associated with the NEI methodology. This analysis documents conformance of the Beaver Valley Power Station Unit No. 2 EALs to the NEI 99-01, Revision 5 EAL developmental guidance.

PROGRAM REQUIREMENTS

10 CFR 50.47(b)(4)

A standard emergency classification and action level scheme, the bases of which include facility system and effluent parameters, is in use by the nuclear facility licensee, and State and local response plans call for reliance on information provided by facility licensees for determinations of minimum initial offsite response measures.

10 CFR 50 Appendix E Section IV.B

The means to be used for determining the magnitude of and for continually assessing the impact of the release of radioactive materials shall be described, including emergency action levels that are to be used as criteria for determining the need for notification and participation of local and State agencies, the Commission, and other Federal agencies, and the emergency action levels that are to be used for determining when and what type of protective measures should be considered within and outside the site boundary to protect health and safety. The emergency action levels shall be based on in-plant conditions and instrumentation in addition to onsite and offsite monitoring. These initial emergency action levels shall be discussed and agreed on by the applicant or licensee and State and local governmental authorities, and approved by NRC. Thereafter, emergency action levels shall also be reviewed with the State and local governmental authorities on an annual basis.

Regulatory Guide 1.101

The NRC has stated, in a letter to the Nuclear Energy Institute, that it will pursue endorsement of NEI 99-01, Revision 5 in Regulatory Guide 1.101, "Emergency Response Planning and Preparedness for Nuclear Power Reactors." The letter further stated that NEI 99-01, Revision 5 was acceptable to the NRC staff as an alternative method for developing EALs required in Section IV.B of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4).

BVPS-2 TO NEI 99-01, Revision 5 IC CROSS REFERENCE TABLES

The following tables provide cross-references between the NEI 99-01 Initiating Condition (IC) identification number and the BVPS-2 IC identification number:

NEI to BVPS-2

NEI	BVPS-2	NEI	BVPS-2
FU1	FU1	SU1	SU1
FA1	FA1	SU2	SU5
FS1	FS1	SU3	SU4
FG1	FG1	SU4	SU9
		SU5	SU7
FC1	FC1	SU6	SU6
FC2	FC7	SU8	SU3
FC3	FC3	SA2	SA3
FC4	FC4	SA4	SA4
FC6	FC2	SA5	SA1
FC7	N/A	SS1	SS1
FC8	FC10	SS2	SS3
		SS3	SS2
RC1	RC1	SS6	SS4
RC2	RC5	SG1	SG1
RC4	RC6	SG2	SG3
RC6	RC2		
RC7	N/A	CU1	CU7
RC8	RC10	CU2	CU8
		CU3	CU1
CT1	N/A	CU4	CU10
CT2	CT8	CU6	CU6
CT3	CT3	CU7	CU2
CT4	CT6	CU8	CU3
CT5	CT9	CA1	CA7
CT6	CT2	CA3	CA1
CT7	N/A	CA4	CA10
CT8	CT10	CS1	CS7
		CG1	CG7
AU1	RU1		
AU2	RU2	HU1	HU3
AA1	RA1	HU2	HU4
AA2	RA2	HU3	HU5
AA3	RA3	HU4	HU1
AS1	RS1	HU5	HU6
AG1	RG1	HA1	HA3
		HA2	HA4
		HA3	HA5
		HA4	HA1
		HA5	HA2
		HA6	HA6
		HS2	HS2
		HS3	HS6
		HS4	HS1
		HG1	HG1
		HG2	HG6
		E-HU1	E-HU1

BVPS-2 to NEI

BVPS-2	NEI	BVPS-2	NEI
FG1	FG1	SG1	SG1
FS1	FS1	SS1	SS1
FA1	FA1	SA1	SA5
FU1	FU1	SU1	SU1
		SS2	SS3
FC1	FC1	SG3	SG2
FC2	FC6	SS3	SS2
FC3	FC3	SA3	SA2
FC4	FC4	SU3	SU8
FC7	FC2	SS4	SS6
N/A	FC7	SA4	SA4
FC10	FC8	SU4	SU3
		SU5	SU2
RC1	RC1	SU6	SU6
RC2	RC6	SU7	SU5
RC5	RC2	SU9	SU4
RC6	RC4		
N/A	RC7	CA1	CA3
RC10	RC8	CU1	CU3
		CU2	CU7
N/A	CT1	CU3	CU8
CT2	CT6	CU6	CU6
CT3	CT3	CG7	CG1
CT6	CT4	CS7	CS1
N/A	CT7	CA7	CA1
CT8	CT2	CU7	CU1
CT9	CT5	CU8	CU2
CT10	CT8	CA10	CA4
		CU10	CU4
RG1	AG1		
RS1	AS1	HG1	HG1
RA1	AA1	HS1	HS4
RU1	AU1	HA1	HA4
RA2	AA2	HU1	HU4
RU2	AU2	HS2	HS2
RA3	AA3	HA2	HA5
		HA3	HA1
		HU3	HU1
		HA4	HA2
		HU4	HU2
		HA5	HA3
		HU5	HU3
		HG6	HG2
		HS6	HS3
		HA6	HA6
		HU6	HU5
		E-HU1	E-HU1

DIFFERENCES – DEVIATIONS

The items considered to be differences or deviations are based on the definitions provided in RIS 2003-18, Supplement 2. Any plant EAL [or Initiating Condition (IC) or Fission Product Barrier (FPB) threshold value] that does not meet the intent of the NEI 99-01, Revision 5 guidance or may result in an event being classified differently from the guidance is identified as a deviation and will be listed as such in this evaluation. The basis section for each of the deviations documents the rationale for not adopting the NEI 99-01, Revision 5 guidance. Items identified as deviations will not be implemented without prior NRC review and approval.

ADMINISTRATIVE CHANGES

The following changes apply throughout the set of EALs and are not specifically identified in the comparison tables:

1. The NEI phrase "NOTIFICATION OF UNUSUAL EVENT" has been changed to "UNUSUAL EVENT" to sustain common terminology.

2. The IC identification numbering has been modified to allow consistent grouping by event category.

3. Numerical values, signs and key words of threshold values are **bolded** for emphasis.

4. The NEI note "[T]he Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the [condition will likely exceed the applicable time.] or [duration has exceeded or will likely to exceed, the applicable time.]" is included at the bottom of each page of the EAL matrix located in the proposed Beaver Valley Power Station Emergency Preparedness Plan, Section 4, "Emergency Conditions." An asterisk is used as a pointer to the EAL which requires the use of the note. In this evaluation, for simplicity, the note is included as part of EAL.

5. Terms that are defined in Beaver Valley Power Station Emergency Preparedness Plan, Section 1, "Definitions," are indicated in the proposed BVPS-2 EALs as all capitals.

6. Used the term none instead of not applicable in the FPB matrix.

These changes are considered administrative in nature and are neither a difference nor a deviation in accordance with RIS 2003-18, Supplement 2.

SUMMARY OF DEVIATIONS FROM NEI 99-01

The following table identifies EAL changes that will require prior NRC approval before implementation. A detailed description of the changes and basis for the changes are contained in the following section.

Deviations from NEI 99-01, Revision 5

#	NEI Ref	BVPS-2 Ref	NEI Guidance	Deviation
1	FC1 RC1	FC1 RC1	Heat Sink - Red	Added the conditional statement "Heat Sink is required" to potential loss threshold #2.
2	CT4	CT6	UNISOLABLE steam release from affected SG to the environment	Specified the UNISOLABLE steam release also be prolonged as stated in the NEI generic bases section.
3	AU2	RU2	VALID Area Radiation Monitor reading rise on (site specific list).	Specified that EAL threshold 1.b rise in the radiation monitor reading results in an alarm.
4	CA4	CA10	EAL #2 does not include consideration of temperature monitoring ability.	Added the conditional statement "RCS temperature cannot be monitored" to EAL #2.

Deviation 1

NEI EAL: FC1/RC1 (NEI 99-01, Revision 5) **BVPS-2 EAL:** FC1/RC1

Operational Modes: 1, 2, 3, 4

Description of the Deviation

Added conditional statement: Heat Sink is required.

Technical Basis

The condition "Heat Sink is required" was added to preclude over-classification for conditions in which RCS pressure is less than steam generator pressure or Heat Sink-Red path entry was created by intentional operator action as directed by the EMERGENCY OPERATING PROCEDURE, "Response To Loss Of Secondary Heat Sink."

The heat sink function is not lost until the EMERGENCY OPERATING PROCEDURE methods for temperature control are shown to be unsuccessful. The "Heat Sink is required" conditional statement allows for the use of available alternate cooling methods, such as safety injection operating, prior to determining that the heat sink function is lost or severely degraded when needed.

Supporting Information

A similar change was approved for use at the North Anna Power Station Units 1 and 2, and the Surry Power Station Units 1 and 2. The initial request was dated March 28, 2007 and was approved by the NRC in a letter dated February 4, 2008.

Deviation 2

NEI EAL: CT4 (NEI 99-01, Revision 5) **BVPS-2 EAL:** CT6

Operational Modes: 1, 2, 3, 4

Description of the Deviation

Revised the NEI fission product barrier wording from:

> UNISOLABLE steam release from affected SG to the environment.

To:

> UNISOLABLE prolonged steam release from affected SG to the environment.

Additionally, the criteria for *prolonged* was established in the site specific technical bases sections and as a note to the fission product barrier specifying that a prolonged release is greater than four hours.

Technical Basis

The NEI 99-01, Revision 5 generic basis states the following:

> The threshold for establishing the UNISOLABLE secondary side release is intended to be a prolonged release of radioactivity from the RUPTURED steam generator directly to the environment. This could be expected to occur when the main condenser is unavailable to accept the contaminated steam (i.e., SG tube rupture with concurrent loss of offsite power and the RUPTURED steam generator is required for plant cooldown or a stuck open relief valve).

The previous approved Beaver Valley EAL scheme, based on NUMARC/NESP-007, included the following basis information regarding the clarification and direction for the meaning of prolonged:

> The duration of 'prolonged' is left to Emergency Director judgment but should typically be on the order of 4 to 8 hours in duration.

The lower threshold value of four hours was used to establish the criteria in the Beaver Valley EAL scheme.

The Beaver Valley Site Specific Basis for the EAL also includes the following:

> The threshold for establishing the UNISOLABLE secondary side release is intended to be a prolonged release of radioactivity from the RUPTURED steam generator directly to the environment. This could be expected to occur when the main condenser is unavailable to accept the contaminated steam (i.e., SG tube rupture with concurrent loss of OFFSITE power and the RUPTURED steam generator is required for plant cooldown or a stuck open relief valve). A prolonged release is greater than 4 hours. The 4 hour

duration is the minimum time to cool down to Mode 5, at 100 degrees/hour, per Technical Specification cooldown limits.

Supporting Information

The generic basis wording in NEI 99-01, Revision 5 clearly establishes the intent of the threshold conditions. This change clarifies the threshold consistent with the technical basis to preclude declaring a loss of fission product barrier before it should be declared.

Deviation 3

NEI EAL: AU2 (NEI 99-01, Revision 5) **BVPS-2 EAL:** RU2

Operational Modes: 1, 2, 3, 4, 5, 6, D

Description of the Deviation

Revised the NEI fission product barrier wording from:

VALID Area Radiation Monitor reading rise on.......

To:

Area radiation monitor rise resulting in a hi alarm on.........

Technical Basis

Radiation levels have been shown to rise in instances where water level has been lowered within the technical specification limit. To establish the EAL threshold for an emergency where a departure below the technical specification limit can be readily restored and is clearly within the action statement will result in an event declaration when an event declaration is not warranted.

NRC Information Notice 87-13, "POTENTIAL FOR HIGH RADIATION FIELDS FOLLOWING LOSS OF WATER FROM FUEL POOL," indicates that even for a mishap that does not completely drain the fuel pool, dose rates from components hanging on the sides of the pool railing may result in dose rates in excess of 100 Rem/hour at the pool edge and greater than 1 Rem/hour six feet from the pool edge.

In this case a minimum EAL threshold value has been established at the monitor alarm setpoints. This value is low enough to meet the meaning and intent of the NEI 99-01 Revision 5 EAL technical basis to provide an indication of loss of water level and high enough to preclude an unwarranted emergency declaration.

Supporting Information

A similar change was approved for use at the North Anna Power Station Units 1 and 2, and the Surry Power Station Units 1 and 2. The initial request was dated March 28, 2007 and was approved by the NRC in a letter dated February 4, 2008.

Deviation 4

NEI EAL: CA4.2 (NEI 99-01, Revision 5) **BVPS-2 EAL:** CA10.2

Operational Modes: 5, 6

Description of the Deviation

Revised the NEI EAL wording from:

2. An UNPLANNED event results in RCS pressure increase greater than 10 psi due to a loss of RCS cooling. (PWR-This EAL does not apply in Solid Plant conditions.)

To:

2. a. RCS temperature cannot be monitored.

   AND

   b. RCS pressure rise **> 10 psi** due to an UNPLANNED loss of decay heat removal capability (this EAL does not apply in RCS solid plant conditions).

Technical Basis

EAL #2 provides an alternate indication of reactor coolant system (RCS) heatup resulting from an UNPLANNED loss of decay heat removal capability. This alternate indication may be used in the event that all RCS temperature indication is unavailable. It also provides a more specific escalation path from BVPS-2 CU10.2, which states an UNUSUAL EVENT is warranted with a loss of all RCS temperature and reactor coolant system/reactor pressure vessel level indication for 15 minutes or longer.

Supporting Information

An engineering evaluation was performed which indicated that it would be possible to obtain a 10 psi rise in pressure prior to reaching 200 degrees. The proposed EAL would preclude entry into EAL CA10.1, and would be consistent with regard to escalation from proposed BVPS-2 EAL CU10.2.

The condition associated with the inability to monitor RCS temperature has been addressed by NEI. In the proposed NEI 99-01, Revision 6, the bases for NEI EAL CA4.2 contains wording associated with the inability to monitor RCS temperature. NEI 99-01, Revision 6 has been forwarded to the NRC for review. The loss of RCS temperature condition contained in the proposed BVPS-2 EAL CA10.2 is consistent with this NEI position.

COMPARISON TABLE

The attached table lists the NEI 99-01, Revision 5 Initiating Conditions, Mode Applicability, and EALs (Threshold Values) to the new BVPS-2 EALs. The table also lists the definitions that were added or modified to support the use of the NEI 99-01, Revision 5 EALs. The table provides a means of easily identifying and assessing the differences and deviations between the two EAL/definition sets.

Discussion of EAL technical bases and lists of source document references are contained in the Beaver Valley Power Station Emergency Preparedness Plan, Section 4, "Emergency Conditions." It is, therefore, advisable to reference that document for background information while using this matrix.

The presentation of the EALs within the matrix is provided in a format based on the example table below:

NEI 99-01, Rev 5	New EALs	Differences/Deviations
EAL Identifier: Initiating Condition: Mode Applicability: Threshold Value(s):	EAL Identifier: Initiating Condition: Mode Applicability: Threshold Value(s):	<u>Differences:</u> <u>Deviations:</u>

Note: Table H-1, which is used to support BVPS-2 EALs HA3, HU3, HA4, and HU4 is located in the Differences/Deviations column, under the summary of differences and deviations. This was done to ensure that the table was located on the same page as the associated EAL.

NEI 99-01 Rev. 5	BVPS-2 Terms	Difference or Deviation
Definitions		
<u>**AFFECTING SAFE SHUTDOWN:**</u> Event in progress has adversely affected functions that are necessary to bring the plant to and maintain it in the applicable HOT or COLD SHUTDOWN condition. Plant condition applicability is determined by Technical Specification LCOs in effect. Example 1: Event causes damage that results in entry into an LCO that requires the plant to be placed in HOT SHUTDOWN. HOT SHUTDOWN is achievable, but COLD SHUTDOWN is not. This event <u>is not</u> "AFFECTING SAFE SHUTDOWN." Example 2: Event causes damage that results in entry into an LCO that requires the plant to be placed in COLD SHUTDOWN. HOT SHUTDOWN is achievable, but COLD SHUTDOWN is not. This event <u>is</u> "AFFECTING SAFE SHUTDOWN."	<u>**AFFECTING SAFE SHUTDOWN:**</u> Event in progress has adversely affected functions that are necessary to bring the plant to and maintain it in the applicable Hot or Cold Shutdown condition. Plant condition applicability is determined by Technical Specification LCOs in effect. Example 1: Event causes damage that results in entry into an LCO that requires the plant to be placed in Hot Shutdown. Hot Shutdown is achievable, but Cold Shutdown is not. This event <u>is not</u> "AFFECTING SAFE SHUTDOWN." Example 2: Event causes damage that results in entry into an LCO that requires the plant to be placed in Cold Shutdown. Hot Shutdown is achievable, but Cold Shutdown is not. This event <u>is</u> "AFFECTING SAFE SHUTDOWN."	<u>**Rev 5 Differences**</u> Hot and Cold Shutdown not completely capitalized due to not being defined terms in EALs. This is considered administrative. <u>**Rev 5 Deviations**</u> None
<u>**BOMB:**</u> Refers to an explosive device suspected of having sufficient force to damage plant systems or structures.	<u>**BOMB:**</u> An explosive device suspected of having sufficient force to damage plant systems or structures.	<u>**Rev 5 Differences**</u> None <u>**Rev 5 Deviations**</u> None
<u>**CIVIL DISTURBANCE:**</u> A group of persons violently protesting station operations or activities at the site.	<u>**CIVIL DISTURBANCE:**</u> A group of persons violently protesting station operations or activities at the site. This event does not involve HOSTILE ACTIONS. Peaceful demonstrations are not CIVIL DISTURBANCES.	<u>**Rev 5 Differences**</u> Revised for consistency with NEI 03-12, "Template for the Security Plan, Training and Qualification Plan, Safeguards Contingency Plan [and Independent Spent Fuel Storage Installation Security Program]," Revision 6. <u>**Rev 5 Deviations**</u> None
	<u>**COMPENSATORY INDICATIONS:**</u> Computer points, In-Plant Computer - IPC (U1), Inadequate Core Cooling Monitor - ICCM (U1), Sequence of Events Recorder - SER (U1), Plant Computer System - PCS (U2), Plant Safety Monitoring System - PSMS (U2) and PI Data (ProcessBook®).	<u>**Rev 5 Differences**</u> Added plant specific definition for generic term used in EALs. <u>**Rev 5 Deviations**</u> None
<u>**CONFINEMENT BOUNDARY:**</u> The barrier(s) between areas containing radioactive substances and the environment.	<u>**CONFINEMENT BOUNDARY:**</u> The barrier(s) between areas containing radioactive substances and the environment.	<u>**Rev 5 Differences**</u> None <u>**Rev 5 Deviations**</u> None
<u>**CONTAINMENT CLOSURE:**</u> The site specific procedurally defined actions taken to secure containment (primary or secondary for BWR) and its associated structures, systems, and components as a functional barrier to fission product release under existing plant conditions.	<u>**CONTAINMENT CLOSURE:**</u> The procedurally defined actions taken to secure primary containment and its associated structures, systems, and components as a functional barrier to fission product release under existing plant conditions.	<u>**Rev 5 Differences**</u> None. Removal of site specific and plant type placeholders from the template is considered administrative. <u>**Rev 5 Deviations**</u> None
<u>**EMERGENCY ACTION LEVEL (EAL)**</u> -- A pre-determined, site specific, observable threshold for a plant IC that places the plant in a given emergency classification level. An EAL can be: an instrument reading; an equipment status indicator; a measurable parameter (on-site or off-site); a discrete, observable event; results of analyses; entry into specific emergency operating procedures; or another phenomenon which, if it occurs, indicates entry into a particular emergency classification level.	<u>**EMERGENCY ACTION LEVEL (EAL)**</u> -- A pre-determined, site specific, observable threshold for a plant IC that places the plant in a given EMERGENCY CLASSIFICATION LEVEL. An EAL can be: an instrument reading; an equipment status indicator; a measurable parameter (ONSITE or OFFSITE); a discrete, observable event; results of analyses; entry into specific EMERGENCY OPERATING PROCEDURES; or another phenomenon which, if it occurs, indicates entry into a particular EMERGENCY CLASSIFICATION LEVEL.	<u>**Rev 5 Differences**</u> None <u>**Rev 5 Deviations**</u> <u>**None**</u>

NEI 99-01 Rev. 5	BVPS-2 Terms	Difference or Deviation
EXPLOSION: A rapid, violent, unconfined combustion, or catastrophic failure of pressurized/energized equipment that imparts energy of sufficient force to potentially damage permanent structures, systems, or components.	**EXPLOSION:** A rapid, violent, unconfined combustion, or catastrophic failure of pressurized/energized equipment that imparts energy of sufficient force to potentially damage permanent structures, systems, or components.	**Rev 5 Differences** None **Rev 5 Deviations** None
EXTORTION: An attempt to cause an action at the station by threat of force.	**EXTORTION:** An attempt to cause an action at the station by threat of force.	**Rev 5 Differences** None **Rev 5 Deviations** None
FAULTED: (PWRs) in a steam generator, the existence of secondary side leakage that results in an uncontrolled drop in steam generator pressure or the steam generator being completely depressurized.	**FAULTED:** In a steam generator, the existence of secondary side leakage that results in an uncontrolled drop in steam generator pressure or the steam generator being completely depressurized.	**Rev 5 Differences** None. Removal of site specific and plant type placeholders from the template is considered administrative. **Rev 5 Deviations** None
FIRE: Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute FIRES. Observation of flame is preferred but is NOT required if large quantities of smoke and heat are observed.	**FIRE:** Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute FIRE. Observation of flame is preferred but is not required if large quantities of smoke and heat are observed.	**Rev 5 Differences** None. Word corrected to singular is considered administrative. **Rev 5 Deviations** None
HOSTAGE: A person(s) held as leverage against the station to ensure that demands will be met by the station.	**HOSTAGE:** A person(s) held as leverage against the station to ensure that demands will be met by the station.	**Rev 5 Differences** None **Rev 5 Deviations** None
HOSTILE ACTION: An act toward a NPP or its personnel that includes the use of violent force to destroy equipment, take HOSTAGES, and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, PROJECTILEs, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. HOSTILE ACTION should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on the NPP. Non-terrorism-based EALs should be used to address such activities (i.e., this may include violent acts between individuals in the owner controlled area).	**HOSTILE ACTION:** An act toward a nuclear power plant or its personnel that includes the use of violent force to destroy equipment, take HOSTAGES, and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, PROJECTILES, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. HOSTILE ACTION should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on the nuclear power plant. Non-terrorism-based EALs should be used to address such activities (i.e., violent acts between individuals in the OWNER CONTROLLED AREA).	**Rev 5 Differences** None. Spelling out of the abbreviation is considered administrative. Eliminated the phrase "this may include" in the last sentence for it is considered redundant verbiage. **Rev 5 Deviations** None
IMMINENT: Mitigation actions have been ineffective, additional actions are not expected to be successful, and trended information indicates that the event or condition will occur. Where IMMINENT timeframes are specified, they shall apply.	**IMMINENT / IMPENDING:** Means about to happen (generally within 30 minutes).	**Rev 5 Differences** Revised for consistency with NEI 03-12, Rev 6. **Rev 5 Deviations** None
INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI): A complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage.	**INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI):** A complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage.	**Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 Terms	Difference or Deviation
INTRUSION: A person(s) present in a specified area without authorization. Discovery of a BOMB in a specified area is indication of INTRUSION into that area by a HOSTILE FORCE.	**INTRUDER / INTRUSION:** A person(s) present in a specified area without authorization. Discovery of a BOMB in a specified area is indication of INTRUSION into that area by a HOSTILE FORCE.	**Rev 5 Differences** Term "INTRUDER" was added for consistency with the first sentence of the definition that applied to a person. **Rev 5 Deviations** None
	LARGE AIRCRAFT: Any size or type of aircraft with the potential for causing significant damage to the plant (refer to the Security Plan for a more detailed definition).	**Rev 5 Differences** Added the definition for "LARGE AIRCRAFT" in accordance with NEI 99-01 Rev 5 FAQ #26. **Rev 5 Deviations** None
	NORMAL LEVELS: The highest reading in the past twenty-four hours excluding the current peak value.	**Rev 5 Differences** Added the definition for "NORMAL LEVELS" in accordance with NEI 99-01 Rev 5, FAQ# 5. **Rev 5 Deviations** None
NORMAL PLANT OPERATIONS: Activities at the plant site associated with routine testing, maintenance, or equipment operations, in accordance with normal operating or administrative procedures. Entry into abnormal or emergency operating procedures, or deviation from normal security or radiological controls posture, is a departure from NORMAL PLANT OPERATIONS.	**NORMAL PLANT OPERATIONS:** Activities at the plant site associated with routine testing, maintenance, or equipment operations, in accordance with normal operating or administrative procedures. Entry into abnormal or EMERGENCY OPERATING PROCEDURES, or deviation from normal security or radiological controls posture, is a departure from NORMAL PLANT OPERATIONS.	**Rev 5 Differences** None **Rev 5 Deviations** None
	OWNER CONTROLLED AREA: The property associated with the station and owned by the company. Access is normally limited to persons entering for official business.	**Rev 5 Differences** Added plant specific definition for generic term used in EALs. **Rev 5 Deviations** None
PROJECTILE: An object directed toward a NPP that could cause concern for its continued operability, reliability, or personnel safety.	**PROJECTILE:** Means a fired, projected object, such as a bullet or pellet having no capacity for self propulsion directed towards a nuclear power plant that could cause concern for its continued operability, reliability or personnel safety.	**Rev 5 Differences** Revised for consistency with NEI 03-12, Rev 6. **Rev 5 Deviations** None
PROTECTED AREA: Typically the site specific area which normally encompasses all controlled areas within the security PROTECTED AREA fence.	**PROTECTED AREA:** Means an area encompassed by physical barriers and to which access is controlled.	**Rev 5 Differences** Revised for consistency with NEI 03-12, Rev 6. **Rev 5 Deviations** None
RUPTURED: (PWRs) in a steam generator, existence of primary-to-secondary leakage of a magnitude sufficient to require or cause a reactor trip and safety injection.	**RUPTURED:** In a steam generator, existence of primary-to-secondary leakage of a magnitude sufficient to require or cause a reactor trip and safety injection.	**Rev 5 Differences** None. Removal of site specific and plant type placeholders from the template is considered administrative. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 Terms	Difference or Deviation
SABOTAGE: Deliberate damage, mis-alignment, or mis-operation of plant equipment with the intent to render the equipment inoperable. Equipment found tampered with or damaged due to malicious mischief may not meet the definition of SABOTAGE until this determination is made by security supervision.	**SABOTAGE:** Deliberate damage, mis-alignment, or mis-operation of plant equipment with the intent to render the equipment inoperable. Equipment found tampered with or damaged due to malicious mischief may not meet the definition of SABOTAGE until this determination is made by security supervision.	**Rev 5 Differences** None **Rev 5 Deviations** None
SECURITY CONDITION: Any Security Event as listed in the approved security contingency plan that constitutes a threat/compromise to site security, threat/risk to site personnel, or a potential degradation to the level of safety of the plant. A SECURITY CONDITION does not involve a HOSTILE ACTION.	**SECURITY CONDITION:** Any Security Event as listed in the approved security contingency plan that constitutes a threat/compromise to site security, threat/risk to site personnel, or a potential degradation to the level of safety of the plant. A SECURITY CONDITION does not involve a HOSTILE ACTION.	**Rev 5 Differences** None **Rev 5 Deviations** None
SIGNIFICANT TRANSIENT: An UNPLANNED event involving one or more of the following: (1) automatic turbine runback greater than 25% thermal reactor power, (2) electrical load rejection greater than 25% full electrical load, (3) Reactor Trip, (4) Safety Injection Activation, or (5) thermal power oscillations greater than 10%.		**Rev 5 Differences** Removed "SIGNIFICANT TRANSIENT" definition in accordance with NEI 99-01 Rev 5, FAQ# 39. **Rev 5 Deviations** None
STRIKE ACTION: A work stoppage within the PROTECTED AREA by a body of workers to enforce compliance with demands made on (site specific). The STRIKE ACTION must threaten to interrupt NORMAL PLANT OPERATIONS.	**STRIKE ACTION:** A work stoppage within the PROTECTED AREA by a body of workers to enforce compliance with demands made on management. The STRIKE ACTION must threaten to interrupt NORMAL PLANT OPERATIONS.	**Rev 5 Differences** None **Rev 5 Deviations** None
UNISOLABLE: A breach or leak that cannot be promptly isolated.	**UNISOLABLE:** A breach or leak that cannot be promptly isolated.	**Rev 5 Differences** None **Rev 5 Deviations** None
UNPLANNED: *A parameter change or an event that is not the result of an intended evolution* and requires corrective or mitigative actions.	**UNPLANNED:** A *parameter change or an event, the reasons for which may be known or* unknown, that is not the result of an intended evolution or expected plant response to a transient.	**Rev 5 Differences** *Change to the definition for "UNPLANNED" in accordance with NEI 99-01 Rev 5, FAQ# 10.* **Rev 5 Deviations** None
VALID: An indication, report, or condition, is considered to be VALID when it is verified by (1) an instrument channel check, (2) indications on related or redundant indicators, or (3) by direct observation by plant personnel, such that doubt related to the indicator's operability, the condition's existence, or the report's accuracy is removed. Implicit in this definition is the need for timely assessment.	**VALID:** An indication, report, or condition, is considered to be VALID when it is verified by (1) an instrument channel check, (2) indications on related or redundant indicators, or (3) by direct observation by plant personnel, such that doubt related to the indicator's operability, the condition's existence, or the report's accuracy is removed. Implicit in this definition is the need for timely assessment.	**Rev 5 Differences** None **Rev 5 Deviations** None
VISIBLE DAMAGE: Damage to equipment or structure that is readily observable without measurements, testing, or analysis. Damage is sufficient to cause concern regarding the continued operability or reliability of the affected structure, system, or component. Example damage includes: deformation due to heat or impact, denting, penetration, rupture, cracking, and paint blistering. Surface *blemishes (e.g., paint chipping, scratches) should not be included.*	**VISIBLE DAMAGE:** Damage to equipment or structure that is readily observable without measurements, testing, or analysis. Damage is sufficient to cause concern regarding the continued availability or reliability of the affected structure, system, or component. Example damage includes: deformation due to heat or impact, denting, penetration, rupture, cracking, and paint blistering. Surface *blemishes (e.g., paint chipping, scratches) should not be included.*	**Rev 5 Differences** The word "operability" was replaced with "availability". This is done to avoid confusion with the need to establish Technical Specification OPERABILITY when determining EAL applicability. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 Terms	Difference or Deviation
VITAL AREAS: Typically any site specific areas, normally within the PROTECTED AREA, that contains equipment, systems, components, or material, the failure, destruction, or release of which could directly or indirectly endanger the public health and safety by exposure to radiation.	VITAL AREA: Means any area that contains VITAL EQUIPMENT.	**Rev 5 Differences** Revised for consistency with NEI 03-12, Rev 6. **Rev 5 Deviations** None
	VITAL EQUIPMENT: Means any equipment, system, device, or material, the failure, destruction, or release of which could directly or indirectly endanger the public health and safety by exposure to radiation. Equipment or systems which would be required to function to protect public health and safety following such failure, destruction, or release are also considered to be vital.	**Rev 5 Differences** Revised for consistency with NEI 03-12, Rev 6. **Rev 5 Deviations** None
EMERGENCY CLASSIFICATION LEVELS		
NOTIFICATION OF UNUSUAL EVENT: Events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring off-site response or monitoring are expected unless further degradation of safety systems occurs.	**UNUSUAL EVENT:** Events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring OFFSITE response or monitoring are expected unless further degradation of safety systems occurs.	**Rev 5 Differences** None **Rev 5 Deviations** None
ALERT: Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA PAG exposure levels.	**ALERT:** Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA PROTECTIVE ACTION GUIDE exposure levels.	**Rev 5 Differences** None. Spelling out of the abbreviation is considered administrative. **Rev 5 Deviations** None
SITE AREA EMERGENCY: Events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts; 1) toward site personnel or equipment that could lead to the likely failure of or; 2) that prevent effective access to, equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PAG exposure levels beyond the site boundary.	**SITE AREA EMERGENCY:** Events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts; 1) toward site personnel or equipment that could lead to the likely failure of or; 2) that prevent effective access to, equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PROTECTIVE ACTION GUIDE exposure levels beyond the site boundary.	**Rev 5 Differences** None. Spelling out of the abbreviation is considered administrative. **Rev 5 Deviations** None
GENERAL EMERGENCY: Events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PAG exposure levels off-site for more than the immediate site area.	**GENERAL EMERGENCY:** Events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PROTECTIVE ACTION GUIDE exposure levels OFFSITE for more than the immediate site area.	**Rev 5 Differences** None. Spelling out of the abbreviation is considered administrative. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
Fission Product Barrier Degradation		
<u>FG1</u> Loss of ANY Two Barriers AND Loss or Potential Loss of the third barrier. Op. Modes: Power Operation, Hot Standby, Startup, Hot Shutdown	<u>FG1</u> **Initiating Condition:** Loss of any two barriers and loss or potential loss of the third barrier. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** Refer to fission product barrier loss and potential loss threshold values to determine barrier status.	**<u>Rev 5 Differences</u>** None **<u>Rev 5 Deviations</u>** None
<u>FS1</u> Loss or Potential Loss of ANY two barriers. Op. Modes: Power Operation, Hot Standby, Startup, Hot Shutdown	<u>FS1</u> **Initiating Condition:** Loss or potential loss of any two barriers. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** Refer to fission product barrier loss and potential loss threshold values to determine barrier status.	**<u>Rev 5 Differences</u>** None **<u>Rev 5 Deviations</u>** None
<u>FA1</u> ANY Loss or ANY Potential Loss of EITHER Fuel Clad OR RCS. Op. Modes: Power Operation, Hot Standby, Startup, Hot Shutdown	<u>FA1</u> **Initiating Condition:** Any loss or any potential loss of either fuel clad or RCS. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** Refer to fission product barrier loss and potential loss threshold values to determine barrier status.	**<u>Rev 5 Differences</u>** None **<u>Rev 5 Deviations</u>** None
<u>FU1</u> ANY Loss or ANY Potential Loss of Containment. Op. Modes: Power Operation, Hot Standby, Startup, Hot Shutdown	<u>FU1</u> **Initiating Condition:** Any loss or any potential loss of containment. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** Refer to fission product barrier loss and potential loss threshold values to determine barrier status.	**<u>Rev 5 Differences</u>** None **<u>Rev 5 Deviations</u>** None
Fuel Clad Barrier		
1. Critical Safety Function Status **<u>Loss</u>** 1. Core-Cooling Red Entry Conditions Met. **<u>Potential Loss</u>** A. Core Cooling - Orange Entry Conditions Met. **OR** B. Heat Sink - Red Entry Conditions Met.	**FC1: Critical Safety Function Status** **<u>Loss</u>** 1. Core Cooling - Red entry conditions met. **<u>Potential Loss</u>** 1. Core Cooling - Orange entry conditions met. **OR** 2. a. Heat Sink - Red entry conditions met. **AND** b. Heat Sink is required.	**<u>Rev 5 Differences</u>** None **<u>Rev 5 Deviations</u>** The conditional statement "Heat Sink is required" was added as a condition to potential loss threshold #2.

<table>
<tr><th>NEI 99-01 Rev. 5</th><th>BVPS-2 EALs</th><th>Difference or Deviation</th></tr>
<tr><td>6. Containment Radiation Monitoring
<u>Loss</u>
A. Containment radiation monitor reading greater than (site specific value).
<u>Potential Loss</u>
Not Applicable</td><td>FC2: Containment Radiation Monitoring
<u>Loss</u>
1. Containment Radiation Monitor (2RMR-RQ206 or 207) > FC2 Line on Graph F-1.
<u>Potential Loss</u>
None</td><td><u>Rev 5 Differences</u>
Removed the word "reading" for human factors considerations (minimize extraneous words).
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td>3. Core Exit Thermocouple Readings
<u>Loss</u>
A. Core exit thermocouples reading greater than (site specific degree F).
<u>Potential Loss</u>
A. Core exit thermocouples reading greater than (site specific degree F).</td><td>FC3: Core Temperature
<u>Loss</u>
1. Three max core exit thermocouples > 1200° F.
<u>Potential Loss</u>
1. Three max core exit thermocouples > 729° F.</td><td><u>Rev 5 Differences</u>
Used a generalized fission product barrier (FPB) category title for fleet standardization terminology.
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td>4. Reactor Vessel Water Level
<u>Loss</u>
Not Applicable
<u>Potential Loss</u>
A. RSC/RPV level less than (site specific level for TOAF).</td><td>FC4: RCS Level
<u>Loss</u>
None
<u>Potential Loss</u>
1. RCS level < Table F-1.
<table><tr><th colspan="3">Table F-1: RVLIS Thresholds</th></tr><tr><th>RVLIS</th><th>RCPs</th><th>Indication</th></tr><tr><td>Full Range</td><td>0</td><td>40%</td></tr><tr><td rowspan="3">Dynamic Range</td><td>1</td><td>25%</td></tr><tr><td>2</td><td>33%</td></tr><tr><td>3</td><td>60%</td></tr></table></td><td><u>Rev 5 Differences</u>
None
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td>2. Primary Coolant Activity Level
<u>Loss</u>
A. Coolant activity greater than (site specific value).
<u>Potential Loss</u>
Not Applicable</td><td>FC7: RCS Activity
<u>Loss</u>
1. Coolant activity > 300 μCi/gm dose equivalent I-131.
<u>Potential Loss</u>
None</td><td><u>Rev 5 Differences</u>
None
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td>7. Other Site Specific Indications
<u>Loss</u>
A. (site specific) as applicable.
<u>Potential Loss</u>
A. (site specific) as applicable.</td><td>N/A</td><td><u>Note:</u> BVPS-2 does not have any additional FPB thresholds in this category.
<u>Rev 5 Differences</u>
None
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td>8. Emergency Director Judgment
<u>Loss</u>
A. Any condition in the opinion of the Emergency Director that indicates Loss of the Fuel Clad Barrier.
<u>Potential Loss</u>
A. Any condition in the opinion of the Emergency Director that indicates Potential Loss of the Fuel Clad Barrier.</td><td>FC10: EMERGENCY DIRECTOR Judgment
<u>Loss</u>
1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the fuel clad barrier.
<u>Potential Loss</u>
1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the fuel clad barrier.</td><td><u>Rev 5 Differences</u>
None
<u>Rev 5 Deviations</u>
None</td></tr>
</table>

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
RCS Barrier		
1. Critical Safety Function Status **Loss** Not Applicable **Potential Loss** A. RCS Integrity - Red Entry Conditions Met. **OR** B. Heat Sink - Red Entry Conditions Met.	**RC1: Critical Safety Function Status** **Loss** None **Potential Loss** 1. RCS Integrity - Orange entry conditions met. **OR** 2. a. Heat Sink - Red entry conditions met. **AND** b. Heat Sink is required.	**Rev 5 Differences** None **Rev 5 Deviations** The conditional statement "Heat Sink is required" was added as a condition to potential loss threshold #2.
6. Containment Radiation Monitoring **Loss** A. Containment radiation monitor reading greater than (site specific value). **Potential Loss** Not Applicable	**RC2: Containment Radiation Monitoring** **Loss** 1. Containment Radiation Monitor (2RMR-RQ206 or 207) > **1.1E+01 R/hr (RC2 Line on Graph F-1)**. **Potential Loss** None	**Rev 5 Differences** Removed the word "reading" for human factors considerations (minimize extraneous words). **Rev 5 Deviations** None
2. RCS Leak Rate **Loss** A. RCS leak rate greater than available makeup capacity as indicated by a loss of RCS subcooling. **Potential Loss** A. RCS leak rate indicated greater than (site specific capacity of one charging pump in the normal charging mode) with Letdown isolated.	**RC5: RCS Leak Rate** **Loss** 1. RCS leak rate greater than available makeup capacity as indicated by RCS subcooling **< 19° normal containment** or **< 46° adverse containment**. **Potential Loss** 1. UNISOLABLE RCS leak exceeding the capacity of one charging pump (130 gpm) in the normal charging mode.	**Rev 5 Differences** (Potential Loss): Removed "with Letdown isolated" to simplify recognition conditions. (Potential Loss): Added "UNISOLABLE" to clarify that the intent is not to declare an emergency for a momentary leak that can be operationally isolated. **Rev 5 Deviations** None
4. SG Tube Rupture **Loss** A. RUPTURED SG results in an ECCS (SI) actuation. **Potential Loss** Not Applicable	**RC6: SG Tube Leakage / Rupture** **Loss** 1. RUPTURED SG results in an SI actuation. **Potential Loss** None	**Rev 5 Differences** Added leakage to FPB category title to allow for consistent language with CT6 (NEI CT4) and fleet standardization. **Rev 5 Deviations** None
7. Other Site Specific Indications **Loss** A. (site specific) as applicable. **Potential Loss** A. (site specific) as applicable.	N/A	**Note:** BVPS-2 does not have any additional FPB thresholds in this category. **Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
8. Emergency Director Judgment **Loss** A. Any condition in the opinion of the Emergency Director that indicates Loss of the RCS Barrier. **Potential Loss** A. Any condition in the opinion of the Emergency Director that indicates Potential Loss of the RCS Barrier.	**RC10: EMERGENCY DIRECTOR Judgment** **Loss** 1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the RCS barrier. **Potential Loss** 1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the RCS barrier.	**Rev 5 Differences** None **Rev 5 Deviations** None
Containment Barrier		
1. Critical Safety Function Status **Loss** Not Applicable **Potential Loss** A. Containment - Red Entry Conditions Met.	**CT1: Critical Safety Function Status** **Loss** None **Potential Loss** 1. Containment - Red Entry Conditions Met.	**Rev 5 Differences** None **Rev 5 Deviations** None
6. Containment Radiation Monitoring **Loss** Not Applicable **Potential Loss** A. Containment radiation monitor reading greater than (site specific value).	**CT2: Containment Radiation Monitoring** **Loss** None **Potential Loss** 1. Containment Radiation Monitor (2RMR-RQ206 or 207) **> CT2 Line on Graph F-2.**	**Rev 5 Differences** Removed the word "reading" for human factors considerations (minimize extraneous words). **Rev 5 Deviations** None
3. Core Exit Thermocouple Readings **Loss** Not Applicable **Potential Loss** A. a. Core exit thermocouples in excess of (site specific)° F. **AND** b. Restoration procedures not effective within 15 minutes. **OR** B. a. Core exit thermocouples in excess of (site specific) F. **AND** b. Reactor vessel level below (site specific level). **AND** c. Restoration procedures not effective within 15 minutes.	**CT3: Core Temperature** **Loss** None **Potential Loss** 1. a. Three max core exit thermocouples **> 2000° F**. **AND** b. Restoration procedures not effective within **15 minutes**. **OR** 2. a. Three max core exit thermocouples **> 1200° F** **AND** b. RVLIS Full Range **< 40%** with no RCPs running. **AND** c. Restoration procedures not effective within **15 minutes**.	**Rev 5 Differences** Used a generalized FPB category title for fleet standardization terminology. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
4. SG Secondary Side Release with P-to-S Leakage **Loss** A. RUPTURED SG is also FAULTED outside of containment. **OR** B. a. Primary-to-Secondary leakrate greater than 10 gpm. **AND** b. UNISOLABLE steam release from affected SG to the environment. **Potential Loss** Not Applicable	**CT6: SG Tube Leakage / Rupture** **Loss** **Note:** A prolonged release is greater than 4 hours. 1. RUPTURED SG is also FAULTED outside of containment. **OR** 2. a. Primary-to-Secondary leak rate **> 10 gpm**. **AND** b. UNISOLABLE prolonged steam release from affected SG to the environment. **Potential Loss** None	**Rev 5 Differences** Revised FPB category title to allow for consistent language with RC6 (NEI RC4) and fleet standardization. Defined the generic basis section term "prolonged" in the site specific basis section and added a note to the EAL section. A prolonged release is greater than 4 hours. The 4 hour duration is the minimum time to cool down to Mode 5, at 100 degrees/hr, per Technical Specification cooldown limits. **Rev 5 Deviations** Specified the UNISOLABLE steam release also be prolonged as stated in the NEI generic bases section.
2. Containment Pressure **Loss** A. A containment pressure rise followed by a rapid unexplained drop in containment pressure. **OR** B. Containment pressure or sump level response not consistent with LOCA conditions. **Potential Loss** A. Containment pressure greater than (site specific value) and rising. **OR** B. Explosive mixture exists inside containment. **OR** C. a. Pressure greater than containment depressurization actuation setpoint. **AND** b. Less than one full train of depressurization equipment operating.	**CT8: Containment Pressure** **Loss** 1. A containment pressure rise followed by a rapid UNPLANNED drop in containment pressure. **OR** 2. Containment pressure or sump level response not consistent with LOCA conditions. **Potential Loss** 1. Containment pressure **> 45 psig** and rising. **OR** 2. Containment hydrogen **> 4%.** **OR** 3. a. Containment pressure **> 11 psig.** **AND** b. Less than one full train of depressurization equipment operating.	**Rev 5 Differences** Replaced "unexplained" with "UNPLANNED" in accordance with NEI 99-01 Rev 5, FAQ# 10. **Rev 5 Deviations** None
5. Containment Isolation Failure or Bypass **Loss** A. a. Failure of all valves in any one line to close. **AND** b. Direct downstream pathway to the environment exists after containment isolation signal. **Potential Loss** Not Applicable	**CT9: Containment Isolation Failure** **Loss** **Note:** Direct pathways include filtered pathways (e.g., SLCRS). 1. a. Failure of **ALL** valves in any one line to close. **AND** b. Direct downstream pathway to the environment exists after containment isolation signal. **Potential Loss** None	**Rev 5 Differences** Revised FPB category title to eliminate bypass reference as there is no threshold for a containment bypass event and fleet standardization. Added a note to the EAL section to clarify that direct downstream pathways include filtered pathways as reworded from the basis section: "The existence of an in-line charcoal filter does not make a release path indirect since the filter is not effective at removing fission product noble gases." Supplementary leak collection and release system (SLCRS) is a filtered pathway **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
7. Other Site Specific Indications **Loss** A. (site specific) as applicable. **Potential Loss** A. (site specific) as applicable.	N/A	**Note:** BVPS-2 does not have any additional FPB thresholds in this category. **Rev 5 Differences** None **Rev 5 Deviations** None
8. Emergency Director Judgment **Loss** A. Any condition in the opinion of the Emergency Director that indicates Loss of the Containment Barrier. **Potential Loss** A. Any condition in the opinion of the Emergency Director that indicates Potential Loss of the Containment Barrier.	**CT10: EMERGENCY DIRECTOR Judgment** **Loss** 1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the containment barrier. **Potential Loss** 1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the containment barrier.	**Rev 5 Differences** None **Rev 5 Deviations** None
Abnormal Rad Condition / Abnormal Rad Effluent Releases		
AG1 **Initiating Condition - GENERAL EMERGENCY** Off-site dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 1000 mrem TEDE or 5000 mrem Thyroid CDE for the actual or projected duration of the release using actual meteorology. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3 or 4) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results. 1. VALID reading on **ANY** of the following radiation monitors greater than the reading shown for 15 minutes or longer: (site specific monitor list and threshold values) 2. Dose assessment using actual meteorology indicates doses greater than 1000 mrem TEDE or 5000 mrem thyroid CDE at or beyond the site boundary. 3. VALID perimeter radiation monitoring system reading greater than 1000 mR/hr for 15 minutes or longer. [for sites having telemetered perimeter monitors] 4. Field survey results indicate closed window dose rates greater than 1000 mR/hr expected to continue for 60 minutes or longer; or analyses of field survey samples indicate thyroid CDE greater than 5000 mrem for one hour of inhalation, at or beyond site boundary.	**RG1** **INITIATING CONDITION:** OFFSITE dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** **Notes:** • The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. • If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results. 1. The following gaseous effluent monitor greater than the reading shown for **15 minutes*** or longer: • SLCRS Vent (2HVS-RQ109E) .... **1.95E+07 µCi/sec** **OR** 2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER** of the following: • **> 1000 mRem** TEDE. • **> 5000 mRem** CDE Child Thyroid. **OR** 3. Field survey results at or beyond the site boundary indicate **EITHER** of the following: • Gamma (closed window) dose rate **> 1000 mR/hr** for **60 minutes*** or longer. • Air sample analysis **> 5000 mRem** CDE Child Thyroid for one hour of inhalation.	**Note:** The EAL thresholds reflect state guidance which evaluate the consequences of radiological releases in terms of a CDE Child Thyroid PAG rather than an EPA-400 CDE Thyroid PAG. **Rev 5 Differences** Provided mRem capitalization consistent with fleet standards in accordance with NEI 99-01 Rev 5, FAQ# 8. Removed "VALID" in accordance with NEI 99-01 Rev 5, FAQ# 4. Removed the word "reading" for human factors considerations (minimize extraneous words). NEI AG1.3 is not applicable (N/A) for BVPS-2 because the plant is not equipped with a perimeter radiation monitoring system. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
AS1 **Initiating Condition - SITE AREA EMERGENCY** Off-site dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 100 mrem TEDE or 500 mrem Thyroid CDE for the actual or projected duration of the release. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3 or 4) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results. 1. VALID reading on **ANY** of the following radiation monitors greater than the reading shown for 15 minutes or longer: (site specific monitor list and threshold values) 2. Dose assessment using actual meteorology indicates doses greater than 100 mrem TEDE or 500 mrem thyroid CDE at or beyond the site boundary. 3. VALID perimeter radiation monitoring system reading greater than 100 mR/hr for 15 minutes or longer. [for sites having telemetered perimeter monitors] 4. Field survey results indicate closed window dose rates greater than 100 mR/hr expected to continue for 60 minutes or longer; or analyses of field survey samples indicate thyroid CDE greater than 500 mrem for one hour of inhalation, at or beyond the site boundary.	**RS1** **INITIATING CONDITION:** OFFSITE dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 100 mRem TEDE or 500 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** **Notes:** • The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. • If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results. 1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **15 minutes*** or longer: • SLCRS Vent (2HVS-RQ109E) .... **1.95E+06 µCi/sec** • Ventilation Vent (2HVS-RQ101B)................................ **1.67E-01 µCi/cc** **OR** 2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER** of the following: • **> 100 mRem** TEDE. • **> 500 mRem** CDE Child Thyroid. **OR** 3. Field survey results at or beyond the site boundary indicate **EITHER** of the following: • Gamma (closed window) dose rate **> 100 mR/hr** for **60 minutes*** or longer. • Air sample analysis **> 500 mRem** CDE Child Thyroid for one hour of inhalation.	**Note:** The EAL thresholds reflect state guidance which evaluate the consequences of radiological releases in terms of a CDE Child Thyroid PAG rather than an EPA-400 CDE Thyroid PAG. **Rev 5 Differences** Added IC wording "using actual meteorology" in accordance with NEI 99-01 Rev 5, FAQ# 9. Provided mRem capitalization consistent with fleet standards in accordance with NEI 99-01 Rev 5, FAQ# 8. Removed "VALID" in accordance with NEI 99-01 Rev 5, FAQ# 4. Removed the word "reading" for human factors considerations (minimize extraneous words). NEI AS1.3 is N/A for BVPS-2 because the plant is not equipped with a perimeter radiation monitoring system. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
<u>AA1</u> **Initiating Condition - ALERT** Any release of gaseous or liquid radioactivity to the environment greater than 200 times the Radiological Effluent Technical Specifications/ODCM for 15 minutes or longer. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3 or 4 or 5) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown. 1. VALID reading on **ANY** of the following radiation monitors greater than the reading shown for 15 minutes or longer: (site specific monitor list and threshold values) 2. VALID reading on any effluent monitor reading that greater than 200 times the alarm setpoint established by a current radioactivity discharge permit for 15 minutes or longer. 3. Confirmed sample analyses for gaseous or liquid releases indicates concentrations or release rates greater than 200 times (site specific RETS values) for 15 minutes or longer. 4. VALID reading on perimeter radiation monitoring system reading greater than 10.0 mR/hr above normal* background for 15 minutes or longer. [for sites having telemetered perimeter monitors] 5. VALID indication on automatic real-time dose assessment capability indicating greater than (site specific value) for 15 minutes or longer. [for sites having such capability] * Normal can be considered as the highest reading in the past twenty-four hours excluding the current peak value.	<u>RA1</u> **INITIATING CONDITION:** Any release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM limit for 15 minutes or longer. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** **<u>Note:</u>** • The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown. 1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **15 minutes*** or longer: • SLCRS Vent (2HVS-RQ109E) .... **5.88E+05 µCi/sec** • Ventilation Vent (2HVS-RQ101B)................................. **6.02E-02 µCi/cc** **OR** 2. Liquid Waste Effluent Monitor (2SGC-RQ100) **> 200 times the High alarm setpoint, not to exceed 4.5E-02 µCi/cc**, established by a current radioactivity discharge permit for **15 minutes*** or longer. **OR** 3. Confirmed sample analysis for gaseous or liquid releases **> 200 times the ODCM limit** for **15 minutes*** or longer.	**<u>Rev 5 Differences</u>** Removed "VALID" in accordance with NEI 99-01 Rev 5, FAQ# 4. Established "NORMAL LEVELS" as a defined term in accordance with NEI 99-01 Rev 5, FAQ# 5. Removed the words "reading" for human factors considerations (minimize extraneous words). NEI AA1.4 is N/A for BVPS-2 because the plant is not equipped with a perimeter radiation monitoring system. NEI AA1.5 is N/A for BVPS-2 because the plant is not equipped with a automatic real-time dose assessment system. **<u>Rev 5 Deviations</u>** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
AU1 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Any release of gaseous or liquid radioactivity to the environment greater than 2 times the Radiological Effluent Technical Specifications/ODCM for 60 minutes or longer. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3 or 4 or 5) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown. 1. VALID reading on **ANY** of the following radiation monitors greater than the reading shown for 60 minutes or longer: (site specific monitor list and threshold values) 2. VALID reading on any effluent monitor reading greater than 2 times the alarm setpoint established by a current radioactivity discharge permit for 60 minutes or longer. 3. Confirmed sample analyses for gaseous or liquid releases indicates concentrations or release rates greater than 2 times (site specific RETS values) for 60 minutes or longer. 4. VALID reading on perimeter radiation monitoring system reading greater than 0.10 mR/hr above normal* background for 60 minutes or longer. [for sites having telemetered perimeter monitors] 5. VALID indication on automatic real-time dose assessment capability indicating greater than (site specific value) for 60 minutes or longer. [for sites having such capability] * Normal can be considered as the highest reading in the past twenty-four hours excluding the current peak value.	**RU1** **INITIATING CONDITION:** Any release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes or longer. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** **Note:** • The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown. 1. **ANY** of the following gaseous effluent monitors greater than the reading shown for **60 minutes*** or longer: • SLCRS Vent (2HVS-RQ109E) .... **5.88E+03 µCi/sec** • Ventilation Vent (2HVS-RQ101B)................................ **6.02E-04 µCi/cc** **OR** 2. Liquid Waste Effluent Monitor (2SGC-RQ100 **> 2 times the High alarm setpoint** established by a current radioactivity discharge permit for **60 minutes*** or longer: **OR** 3. Confirmed sample analysis for gaseous or liquid releases **> 2 times the ODCM limit** for **60 minutes*** or longer.	**Rev 5 Differences** Removed "VALID" in accordance with NEI 99-01 Rev 5, FAQ# 4. Established "NORMAL LEVELS" as a defined term in accordance with NEI 99-01 Rev 5, FAQ# 5. Removed the words "reading" for human factors considerations (minimize extraneous words). EAL AU1.4 is N/A for BVPS-2 because the plant is not equipped with a perimeter radiation monitoring system. EAL AU1.5 is N/A for BVPS-2 because the plant is not equipped with a automatic real-time dose assessment system. **Rev 5 Deviations** None
AA2 **Initiating Condition - ALERT** Damage to irradiated fuel or loss of water level that has resulted or will result in the uncovering of irradiated fuel outside the reactor vessel. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2) 1. A water level drop in the reactor refueling cavity, spent fuel pool or fuel transfer canal that will result in irradiated fuel becoming uncovered. 2. A VALID alarm or (site specific elevated reading) on **ANY** of the following due to damage to irradiated fuel or loss of water level. (site-specific radiation monitors)	**RA2** **INITIATING CONDITION:** Damage to irradiated fuel or loss of water level that has resulted or will result in the uncovering of irradiated fuel outside the reactor vessel. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. A water level drop in the spent fuel pool, transfer tube or cavity that will result in irradiated fuel becoming uncovered. **OR** 2. **> 1000 mR/hr** on **ANY** of the following due to damage to irradiated fuel or loss of water level: • Manipulator Crane (2RMR-RQ203) • Fuel Pit Bridge (2RMF-RQ202)	**Rev 5 Differences** Removed the words "reading" for human factors considerations (minimize extraneous words). Removed "VALID" in accordance with NEI 99-01 Rev 5, FAQ# 4. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
AU2 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** UNPLANNED rise in plant radiation levels. **Operating Mode Applicability**: All **Example Emergency Action Level:** (1 or 2) 1. a. UNPLANNED water level drop in a reactor refueling pathway as indicated by (site specific level or indication). **AND** b. VALID Area Radiation Monitor reading rise on (site specific list). 2. UNPLANNED VALID Area Radiation Monitor readings or survey results indicate a rise by a factor of 1000 over normal* levels. * Normal levels can be considered as the highest reading in the past twenty-four hours excluding the current peak value.	**RU2** **INITIATING CONDITION:** UNPLANNED rise in plant radiation levels. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. a. UNPLANNED water level drop in the spent fuel pool, transfer canal or reactor cavity as indicated by level **< Tech Spec Minimum (23 feet)**. **AND** b. Area radiation monitor rise resulting in a hi alarm on **ANY** of the following: • Manipulator Crane (2RMR-RQ203) • Fuel Pit Bridge (2RMF-RQ202) **OR** 2. UNPLANNED area radiation monitor or radiation survey **> 1000 times NORMAL LEVELS**.	**Rev 5 Differences** Specified components of "reactor refueling pathway" in accordance with NEI 99-01 Rev 5, FAQ# 6. Removed "VALID" in accordance with NEI 99-01 Rev 5, FAQ# 4. Established "NORMAL LEVELS" as a defined term in accordance with NEI 99-01 Rev 5, FAQ# 5. Removed the words "reading" and "indicate" for human factors considerations (minimize extraneous words). **Rev 5 Deviations** Specified that EAL threshold 1.b rise in the radiation monitor reading results in an alarm.
AA3 **Initiating Condition - ALERT** Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions. **Operating Mode Applicability**: All **Example Emergency Action Level:** (1 or 2) Dose rate greater than 15 mR/hr in **ANY** of the following areas requiring continuous occupancy to maintain plant safety functions: (site specific area list)	**RA3** **INITIATING CONDITION:** Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. Dose rate **> 15 mR/hr** in **ANY** of the following areas requiring continuous occupancy to maintain plant safety functions: • CONTROL ROOM • Central Alarm Station • Secondary Alarm Station	**Rev 5 Differences** None **Rev 5 Deviations** None
Hazards and Other Conditions Affecting Plant Safety		
HG1 **Initiating Condition - GENERAL EMERGENCY** HOSTILE ACTION resulting in loss of physical control of the facility. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2) 1. A HOSTILE ACTION has occurred such that plant personnel are unable to operate equipment required to maintain safety functions. 2. A HOSTILE ACTION has caused failure of Spent Fuel Cooling Systems and IMMINENT fuel damage is likely for a freshly off-loaded reactor core in pool.	**HG1** **INITIATING CONDITION:** HOSTILE ACTION resulting in loss of physical control of the facility. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. A HOSTILE ACTION has occurred such that plant personnel are unable to operate equipment required to maintain safety functions listed below: • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink) **OR** 2. A HOSTILE ACTION has caused failure of spent fuel cooling systems and IMMINENT fuel damage is likely.	**Rev 5 Differences** Created a generalized category list of the equipment required to maintain safety functions in the Basis of HG1.1 (brought forward from basis). Removed "for a freshly off-loaded reactor core in pool" in accordance with NEI 99-01 Rev 5, FAQ# 29. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
HS4 **Initiating Condition - SITE AREA EMERGENCY** HOSTILE ACTION within the PROTECTED AREA. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the (site security shift supervision).	**HS1** **INITIATING CONDITION:** HOSTILE ACTION within the PROTECTED AREA. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the Security Shift Supervisor.	**Rev 5 Differences** None **Rev 5 Deviations** None
HA4 **Initiating Condition - ALERT** HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2) 1. A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLED AREA as reported by the (site specific security shift supervision). 2. A validated notification from NRC of an airliner attack threat within 30 minutes of the site.	**HA1** **INITIATING CONDITION:** HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the Security Shift Supervisor. **OR** 2. A validated notification from the NRC of a LARGE AIRCRAFT attack threat within **30 minutes** of the site.	**Rev 5 Differences** Changed airliner to "LARGE AIRCRAFT" in accordance with NEI 99-01 Rev 5 FAQ# 26. **Rev 5 Deviations** None
HU4 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3) 1. A SECURITY CONDITION that does NOT involve a HOSTILE ACTION as reported by the (site specific security shift supervision). 2. A credible site specific security threat notification. 3. A validated notification from NRC providing information of an aircraft threat.	**HU1** **INITIATING CONDITION:** Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. A SECURITY CONDITION that does not involve a HOSTILE ACTION as reported by the Security Shift Supervisor. **OR** 2. A credible site specific security threat notification. **OR** 3. A validated notification from the NRC providing information of a LARGE AIRCRAFT threat.	**Rev 5 Differences** Changed aircraft to "LARGE AIRCRAFT" in accordance with NEI 99-01 Rev 5 FAQ# 26. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
<u>HS2</u> **Initiating Condition - SITE AREA EMERGENCY** Control room evacuation has been initiated and plant control cannot be established. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. a. Control room evacuation has been initiated. **AND** b. Control of the plant cannot be established within (site specific minutes).	**<u>HS2</u>** **INITIATING CONDITION:** CONTROL ROOM evacuation has been initiated and plant control cannot be established. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. a. CONTROL ROOM evacuation has been initiated. **AND** b. Control of **ANY** of the following safety functions is not established from an alternate location within **15 minutes**. • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink)	**<u>Rev 5 Differences</u>** Created a generalized category list of the equipment required to maintain safety functions in the Basis of HG1.1 (brought forward from basis). **<u>Rev 5 Deviations</u>** None
<u>HA5</u> **Initiating Condition - ALERT** Control room evacuation has been initiated. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. <u>(Site-specific procedure)</u> requires control room evacuation.	**<u>HA2</u>** **INITIATING CONDITION:** CONTROL ROOM evacuation has been initiated. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. CONTROL ROOM evacuation has been initiated.	**<u>Rev 5 Differences</u>** Removed reference to a site specific procedure in accordance with NEI 99-01 Rev 5, FAQ# 28. **<u>Rev 5 Deviations</u>** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
HA1 **Initiating Condition - ALERT** Natural or destructive phenomena affecting VITAL AREAS. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3 or 4 or 5 or 6) 1. a. Seismic event greater than Operating Basis Earthquake (OBE) as indicated by (site specific seismic instrumentation) reading (site specific OBE limit). **AND** b. Earthquake confirmed by **ANY** of the following: • Earthquake felt in plant • National Earthquake Center • Control Room indication of degraded performance of systems required for the safe shutdown of the plant. 2. Tornado striking or high winds greater than (site specific mph) resulting in VISIBLE DAMAGE to **ANY** of the following structures containing safety systems or components **OR** control room indication of degraded performance of those safety systems: (site specific structure list) 3. Internal flooding in **ANY** of the following areas resulting in an electrical shock hazard that precludes access to operate or monitor safety equipment **OR** control room indication of degraded performance of those safety systems: (site specific area list) 4. Turbine failure-generated PROJECTILES resulting in VISIBLE DAMAGE to or penetration of **ANY** of the following structures containing safety systems or components **OR** control room indication of degraded performance of those safety systems: (site specific structure list) 5. Vehicle crash resulting in VISIBLE DAMAGE to **ANY** of the following structures containing safety systems or components **OR** control room indication of degraded performance of those safety systems: (site specific structure list) 6. (Site specific occurrences) resulting in VISIBLE DAMAGE to **ANY** of the following structures containing safety systems or components **OR** control room indication of degraded performance of those safety systems: (site specific structure list)	**HA3** **INITIATING CONDITION:** Natural or destructive phenomena affecting VITAL AREAS. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. a. Seismic event **> 0.06g (OBE)** acceleration (as indicated by lit lamp on 2ERS-CCC-1, Seismic Instrumentation Central Control Cabinet). **AND** b. Earthquake confirmed by **ANY** of the following: • Earthquake felt in plant. • National Earthquake Center. • CONTROL ROOM indication of degraded performance of systems required for the safe shutdown of the plant. **OR** 2. Tornado or high winds **> 80 mph** resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems. **OR** 3. Internal flooding in **Table H-1** areas resulting in **EITHER** of the following: • Electrical shock hazard that precludes access to operate or monitor safety equipment. • CONTROL ROOM indication of degraded performance of those safety systems. **OR** 4. High river water level **> 705 feet MSL** resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems. **OR** 5. Low river level (LR-1CW-101) **< 650 feet MSL** resulting in CONTROL ROOM indication of degraded performance of safety systems located in **Table H-1** areas. **OR** 6. Turbine failure-generated PROJECTILES resulting in **EITHER** of the following: • VISIBLE DAMAGE to or penetration of **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems. **OR** 7. Vehicle crash resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems.	**Rev 5 Differences** Removed HA3.2 tornado "striking" as it is irrelevant whether it strikes or not if it causes VISIBLE DAMAGE to structures containing safety systems or components. Altered the EAL sequence to allow for site specific external flooding EAL to follow internal flooding EAL (human factors). **Rev 5 Deviations** None **Table** **Table H-1** • Cable Vault and Rod Control Bldg • Containment Building • Control Building • Demin. Water Storage (2FWE-TK210) • Diesel Generator Building • Fuel Handling Building • Intake Structure Pump Cubicles • Main Steam Valve Room • Primary Aux. Building (except elev. 773') • RWST (2QSS-TK21) • Safeguards Building • Service Building (except FW Reg Vlv Rm)

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
HU1 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Natural or destructive phenomena affecting the PROTECTED AREA. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2 or 3 or 4 or 5) 1. Seismic event identified by **ANY** 2 of the following: • Seismic event confirmed by (site specific indication or method) • Earthquake felt in plant • National Earthquake Center 2. Tornado striking within the PROTECTED AREA boundary or high winds greater than (site specific mph). 3. Internal flooding that has the potential to affect safety related equipment required by Technical Specifications for the current operating mode in **ANY** of the following areas: (site specific area list) 4. Turbine failure resulting in casing penetration or damage to turbine or generator seals. 5. (Site specific occurrences affecting PROTECTED AREA).	**HU3** **INITIATING CONDITION:** Natural or destructive phenomena affecting the PROTECTED AREA. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. a. Seismic event **> 0.01g** acceleration (as indicated by initiation of the **Accelerograph Recording System** on Ann A10-5H, Init of Seismic Exceed Preset and/or Spectral Accelerations). **AND** b. Earthquake confirmed by **EITHER** of the following: • Earthquake felt in plant. • National Earthquake Center. **OR** 2. a. Tornado within the PROTECTED AREA. **OR** b. High winds **> 80 mph**. **OR** 3. Internal flooding in **Table H-1** areas that has the potential to affect safety related equipment required by Technical Specifications for the current operating mode. **OR** 4. High river water level **> 705 feet MSL**. **OR** 5. Low river water level (LR-1CW-101) **< 650 feet MSL**. **OR** 6. Turbine failure resulting in casing penetration or damage to turbine or generator seals.	**Rev 5 Differences** Nested HU3.1 to match HA3.1. NEI wording was established to accommodate plants that were not capable measuring ground motion at the UE level. BVPS-2 is capable of such monitoring. Removed HU3.2 tornado "striking" as it is irrelevant whether it strikes within the PROTECTED AREA if the tornado itself is within the PROTECTED AREA. Altered the EAL sequence to allow for site specific external flooding EAL to follow internal flooding EAL (human factors). **Rev 5 Deviations** None **Table** **Table H-1** • Cable Vault and Rod Control Bldg • Containment Building • Control Building • Demin. Water Storage (2FWE-TK210) • Diesel Generator Building • Fuel Handling Building • Intake Structure Pump Cubicles • Main Steam Valve Room • Primary Aux. Building (except elev. 773') • RWST (2QSS-TK21) • Safeguards Building • Service Building (except FW Reg Vlv Rm)

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
HA2 **Initiating Condition - ALERT** FIRE or EXPLOSION affecting the operability of plant safety systems required to establish or maintain safe shutdown. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. FIRE or EXPLOSION resulting in VISIBLE DAMAGE to **ANY** of the following structures containing safety systems or components **OR** control room indication of degraded performance of those safety systems: (site specific structure list)	HA4 **INITIATING CONDITION:** FIRE or EXPLOSION affecting the operability of plant safety systems required to establish or maintain safe shutdown. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. FIRE or EXPLOSION resulting in **EITHER** of the following: • VISIBLE DAMAGE to **ANY** structures in **Table H-1** areas containing safety systems or components. • CONTROL ROOM indication of degraded performance of those safety systems.	Rev 5 Differences None Rev 5 Deviations None Table **Table H-1** • Cable Vault and Rod Control Bldg • Containment Building • Control Building • Demin. Water Storage (2FWE-TK210) • Diesel Generator Building • Fuel Handling Building • Intake Structure Pump Cubicles • Main Steam Valve Room • Primary Aux. Building (except elev. 773') • RWST (2QSS-TK21) • Safeguards Building • Service Building (except FW Reg Vlv Rm)

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
HU2 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** FIRE within the PROTECTED AREA not extinguished within 15 minutes of detection or EXPLOSION within the PROTECTED AREA. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the duration has exceeded, or will likely exceed, the applicable time. 1. FIRE not extinguished within 15 minutes of control room notification or verification of a control room FIRE alarm in **ANY** of the following areas: (site specific area list) 2. EXPLOSION within the PROTECTED AREA.	**HU4** **INITIATING CONDITION:** FIRE within the PROTECTED AREA not extinguished within 15 minutes of detection or EXPLOSION within the PROTECTED AREA. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** **Notes:** • The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the duration has exceeded, or will likely exceed, the applicable time. • Immediately adjacent to applies to FIRES that directly impact or obstruct the areas of concern. 1. FIRE not extinguished within **15 minutes** of CONTROL ROOM notification or verification of a CONTROL ROOM FIRE alarm in actual contact with or immediately adjacent to **ANY** of the **Table H-1** areas. **OR** 2. EXPLOSION within the PROTECTED AREA.	**Rev 5 Differences** Added "in actual contact with or immediately adjacent to" from the basis section to HU4.1 to support the use of table H-1. **Rev 5 Deviations** None **Table** **Table H-1** • Cable Vault and Rod Control Bldg • Containment Building • Control Building • Demin. Water Storage (2FWE-TK210) • Diesel Generator Building • Fuel Handling Building • Intake Structure Pump Cubicles • Main Steam Valve Room • Primary Aux. Building (except elev. 773') • RWST (2QSS-TK21) • Safeguards Building • Service Building (except FW Reg Vlv Rm)
HA3 **Initiating Condition - ALERT** Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of operable equipment required to maintain safe operations or safely shutdown the reactor. **Operating Mode Applicability:** All **Example Emergency Action Level:** **Note:** If the equipment in the stated area was already inoperable, or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event. 1. Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of systems required to maintain safe operations or safely shutdown the reactor.	**HA5** **INITIATING CONDITION:** Access to a VITAL AREA is prohibited due to release of toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of operable equipment required to maintain safe operations or safely shutdown the reactor. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** **Notes:** • If the equipment in the stated area was already inoperable, or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event. • This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area. 1. Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of systems required to maintain safe operations or safely shutdown the reactor.	**Rev 5 Differences** Added generic bases information regarding applicability per NEI 99-01 Rev 5, FAQ# 24 and pulled in to notes. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
HU3 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Release of toxic, corrosive, asphyxiant or flammable gases deemed detrimental to NORMAL PLANT OPERATIONS. **Operating Mode Applicability:** All **Example Emergency Action Level:** (1 or 2) 1. Toxic, corrosive, asphyxiant or flammable gases in amounts that have or could adversely affect NORMAL PLANT OPERATIONS. 2. Report by local, county or state officials for evacuation or sheltering of site personnel based on an off-site event.	**HU5** **INITIATING CONDITION:** Release of toxic, corrosive, asphyxiant or flammable gases deemed detrimental to NORMAL PLANT OPERATIONS. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** **Note:** This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area. 1. Toxic, corrosive, asphyxiant or flammable gases in amounts that have or could adversely affect NORMAL PLANT OPERATIONS. **OR** 2. Report by local, county or state officials for evacuation or sheltering of site personnel based on an OFFSITE event.	**Rev 5 Differences** Added generic bases information regarding applicability per NEI 99-01 Rev 5, FAQ# 24 and pulled in to notes. **Rev 5 Deviations** None
HG2 **Initiating Condition - GENERAL EMERGENCY** Other conditions exist which in the judgment of the Emergency Director warrant declaration of a General Emergency. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA Protective Action Guideline exposure levels off-site for more than the immediate site area.	**HG6** **INITIATING CONDITION:** Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of GENERAL EMERGENCY. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PROTECTIVE ACTION GUIDE exposure levels OFFSITE for more than the immediate site area.	**Rev 5 Differences** None **Rev 5 Deviations** None
HS3 **Initiating Condition - SITE AREA EMERGENCY** Other conditions exist which in the judgment of the Emergency Director warrant declaration of a Site Area Emergency. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts; (1) toward site personnel or equipment that could lead to the likely failure of or; (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA Protective Action Guideline exposure levels beyond the site boundary.	**HS6** **INITIATING CONDITION:** Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of SITE AREA EMERGENCY. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts: (1) toward site personnel or equipment that could lead to the likely failure of or, (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PROTECTIVE ACTION GUIDE exposure levels beyond the site boundary.	**Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
HA6 **Initiating Condition - ALERT** Other conditions exist which in the judgment of the Emergency Director warrant declaration of an Alert. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which involve actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA Protective Action Guideline exposure levels.	**HA6** **INITIATING CONDITION:** Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an ALERT. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA PROTECTIVE ACTION GUIDE exposure levels.	**Rev 5 Differences** None **Rev 5 Deviations** None
HU5 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Other conditions exist which in the judgment of the Emergency Director warrant declaration of a NOUE. **Operating Mode Applicability:** All **Example Emergency Action Level:** 1. Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring off-site response or monitoring are expected unless further degradation of safety systems occurs.	**HU6** **INITIATING CONDITION:** Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an UNUSUAL EVENT. **Operating Mode Applicability:** 1, 2, 3, 4, 5, 6, D **EALs:** 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring OFFSITE response or monitoring are expected unless further degradation of safety systems occurs.	**Rev 5 Differences** None **Rev 5 Deviations** None
E-HU1 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Damage to a loaded cask CONFINEMENT BOUNDARY. **Operating Mode Applicability:** Not applicable **Example Emergency Action Level:** 1. Damage to a loaded cask CONFINEMENT BOUNDARY.	**E-HU1** **INITIATING CONDITION:** Damage to a loaded cask CONFINEMENT BOUNDARY. **Operating Mode Applicability:** Not Applicable **EALs:** 1. Damage to a loaded cask CONFINEMENT BOUNDARY.	**Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
System Malfunctions - Hot		
SG1 **Initiating Condition - GENERAL EMERGENCY** Prolonged loss of all Off-site and all On-Site AC power to emergency busses. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** 1. a. Loss of all off-site and on-site AC power to (site specific emergency busses). **AND** b. **EITHER** of the following: • Restoration of at least one emergency bus in less than (site specific hours) is not likely. • (Site specific Indication of continuing degradation of core cooling based on Fission Product Barrier monitoring.)	**SG1** **INITIATING CONDITION:** Prolonged loss of all OFFSITE and all ONSITE AC power to emergency busses. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** 1. a. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses. **AND** b. **EITHER** of the following: • Restoration of **EITHER** the AE 4KV emergency bus **OR** DF 4KV emergency bus within **4 hours** is not likely. • Core Cooling - Red entry conditions met.	**Rev 5 Differences** None **Rev 5 Deviations** None
SS1 **Initiating Condition - SITE AREA EMERGENCY** Loss of all Off-site and all On-Site AC power to emergency busses for 15 minutes or longer. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. Loss of all Off-Site and all On-Site AC power to (site specific emergency busses) for 15 minutes or longer.	**SS1** **INITIATING CONDITION:** Loss of all OFFSITE and all ONSITE AC power to emergency busses for 15 minutes or longer. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Notes:** • The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. • Credit cannot be taken for emergency busses being powered from the other unit's emergency diesel generators. 1. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes*** or longer.	**Rev 5 Differences** Added note from bases section to ensure the cross-tie was not credited as a source of OFFSITE power. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
SA5 **Initiating Condition - ALERT** AC power capability to emergency busses reduced to a single power source for 15 minutes or longer such that any additional single failure would result in station blackout. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. a. AC power capability to (site-specific emergency busses) reduced to a single power source for 15 minutes or longer. **AND** b. Any additional single power source failure will result in station blackout.	**SA1** **INITIATING CONDITION:** AC power capability to emergency busses reduced to a single source for 15 minutes or longer. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. a. AC power to AE and DF 4KV emergency busses is reduced to a single power source for **15 minutes*** or longer. **AND** b. Any additional single power source failure will result in loss of **ALL** AC power to **BOTH** AE and DF 4KV emergency busses.	**Rev 5 Differences** Changed IC and EAL terminology for consistency in accordance with NEI 99-01 Rev 5, FAQ# 36. **Rev 5 Deviations** None
SU1 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Loss of all Off-site AC power to emergency busses for 15 minutes or longer. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. Loss of all off-site AC power to (site-specific emergency busses) for 15 minutes or longer.	**SU1** **INITIATING CONDITION:** Loss of all OFFSITE AC power to emergency busses for 15 minutes or longer. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. Loss of **ALL** OFFSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes*** or longer.	**Rev 5 Differences** None **Rev 5 Deviations** None
SS3 **Initiating Condition - SITE AREA EMERGENCY** Loss of all vital DC power for 15 minutes or longer. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. Less than (site specific bus voltage indication) on all (site specific Vital DC busses) for 15 minutes or longer.	**SS2** **INITIATING CONDITION:** Loss of all vital DC power for 15 minutes or longer. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. **< 110.4 VDC** on **ALL** safety related DC busses (2-1, 2-2, 2-3 and 2-4) for **15 minutes*** or longer.	**Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
SG2 **Initiating Condition - GENERAL EMERGENCY** Automatic Scram (Trip) and all manual actions fail to shutdown the reactor and indication of an extreme challenge to the ability to cool the core exists. **Operating Mode Applicability:** Power Operation, Startup **Example Emergency Action Level:** 1. a. An automatic scram (trip) failed to shutdown the reactor. **AND** b. All manual actions do not shutdown the reactor as indicated by (site specific indications of reactor not shutdown). **AND** c. **EITHER** of the following exist or have occurred due to continued power generation: • (Site specific indication that core cooling is extremely challenged.) • (Site specific indication that heat removal is extremely challenged.)	**SG3** **INITIATING CONDITION:** Automatic trip and all manual actions failed to shutdown the reactor and indication of an extreme challenge to the ability to cool the core exists. **Operating Mode Applicability:** 1, 2 **EALs:** 1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power > 5%. **AND** b. **ALL** manual trip actions failed to shutdown the reactor as indicated by reactor power > 5%. **AND** c. **EITHER** of the following has occurred: • Core Cooling - Red entry conditions met. • Heat Sink - Red entry conditions met.	**Rev 5 Differences** Changed IC and EAL terminology for consistency in accordance with NEI 99-01 Rev 5, FAQ# 31. Removed the SG3.1.c words "exist or" for human factors considerations (minimize extraneous words). Revised tense in EAL 1.b to reflect consistency with wording in EAL 1.a. **Rev 5 Deviations** None
SS2 **Initiating Condition - SITE AREA EMERGENCY** Automatic Scram (Trip) fails to shutdown the reactor and manual actions taken from the reactor control console are not successful in shutting down the reactor. **Operating Mode Applicability:** Power Operation, Startup **Example Emergency Action Level:** 1. a. An automatic scram (trip) failed to shutdown the reactor. **AND** b. Manual actions taken at the reactor control console do not shutdown the reactor as indicated by (site specific indications of reactor not shutdown).	**SS3** **INITIATING CONDITION:** Automatic trip and manual actions taken within the Controls Area (CA) failed to shutdown the reactor. **Operating Mode Applicability:** 1, 2 **EALs:** 1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power > 5%. **AND** b. Manual trip actions taken within the Controls Area (CA) failed to shutdown the reactor as indicated by reactor power > 5%.	**Rev 5 Differences** IC and EAL wording changed from "from the reactor controls console" to "within the Controls Area (CA)" to be consistent with site specific terminology. Changed IC and EAL terminology for consistency in accordance with NEI 99-01 Rev 5, FAQ# 31. Also specified manual "trip" actions to distinguish from emergency boration actions. **Rev 5 Deviations** None
SA2 **Initiating Condition - ALERT** Automatic Scram (Trip) fails to shutdown the reactor and the manual actions taken from the reactor control console are successful in shutting down the reactor. **Operating Mode Applicability:** Power Operation, Startup **Example Emergency Action Level:** 1. a. An automatic scram (trip) failed to shutdown the reactor. **AND** b. Manual actions taken at the reactor control console successfully shutdown the reactor as indicated by (site specific indications of plant shutdown).	**SA3** **INITIATING CONDITION:** Automatic trip failed to shutdown the reactor and the manual actions taken from the Controls Area (CA) are successful in shutting down the reactor. **Operating Mode Applicability:** 1, 2 **EALs:** 1. a. An automatic reactor trip failed to shutdown the reactor. **AND** b. Manual trip actions taken within the Controls Area (CA) successfully shutdown the reactor as indicated by reactor power $\leq$ 5%.	**Rev 5 Differences** IC and EAL wording changed from "from the reactor controls console" to "within the Controls Area (CA)" to be consistent with site specific terminology. Changed IC and EAL terminology for consistency in accordance with NEI 99-01 Rev 5, FAQ# 31. Also specified manual "trip" actions to distinguish from emergency boration actions. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
SU8 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Inadvertent Criticality. **Operating Mode Applicability:** Hot Standby, Hot Shutdown **Example Emergency Action Level:** 1. UNPLANNED sustained positive period observed on nuclear instrumentation. [*BWR*] 1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation. [*PWR*]	**SU3** **INITIATING CONDITION:** Inadvertent criticality. **Operating Mode Applicability:** 3, 4 EALs: 1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.	**Rev 5 Differences** None **Rev 5 Deviations** None
SS6 **Initiating Condition - SITE AREA EMERGENCY** Inability to monitor a SIGNIFICANT TRANSIENT in progress. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. a. Loss of greater than approximately 75% of the following for 15 minutes or longer: • (Site specific control room safety system annunciation) **OR** • (Site specific control room safety system indication) **AND** b. A SIGNIFICANT TRANSIENT is in progress. **AND** c. Compensatory indications are unavailable.	**SS4** **INITIATING CONDITION:** Inability to monitor a significant transient in progress. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. a. Loss of **> 75%** of **EITHER** of the following for **15 minutes*** or longer: • CONTROL ROOM Annunciator Panels (A1, A2, A4 - A11). **OR** • CONTROL ROOM critical safety function indications (Table S-1). **Table S-1: Critical Safety Functions** • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink) **AND** b. A **Table S-2** significant transient is in progress. **Table S-2: Significant Transients** • Automatic turbine runback > 25% thermal power • Electrical load rejection > 25% full electrical load • Reactor trip • Safety Injection actuation **AND** c. COMPENSATORY INDICATIONS are unavailable.	**Rev 5 Differences** Changed significant transient criteria in accordance with NEI 99-01 Rev 5, FAQ# 39. Created a generalized category list of the equipment required to maintain safety functions in the Basis of HG1.1 (brought forward from basis). Removed "approximately" in SS4.1.a to eliminate ambiguity. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
SA4 **Initiating Condition - ALERT** UNPLANNED Loss of safety system annunciation or indication in the control room with EITHER (1) a SIGNIFICANT TRANSIENT in progress, or (2) compensatory indicators unavailable. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. a. UNPLANNED loss of greater than approximately 75% of the following for 15 minutes or longer: • (Site specific control room safety system annunciation) **OR** • (Site specific control room safety system indication) b. **EITHER** of the following: • A SIGNIFICANT TRANSIENT is in progress. • Compensatory indications are unavailable.	**SA4** **INITIATING CONDITION:** Loss of safety system annunciation or indication in the CONTROL ROOM with either: (1) a significant transient in progress, or (2) COMPENSATORY INDICATIONS are unavailable. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. 1. a. Loss of **> 75%** of **EITHER** of the following for **15 minutes*** or longer: • CONTROL ROOM Annunciator Panels (A1, A2, A4 - A11). **OR** • CONTROL ROOM critical safety function indications (Table S-1). **Table S-1: Critical Safety Functions** • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink) **AND** b. **EITHER** of the following: • A **Table S-2** significant transient is in progress. **Table S-2: Significant Transients** • Automatic turbine runback > 25% thermal power • Electrical load rejection > 25% full electrical load • Reactor trip • Safety Injection actuation **OR** • COMPENSATORY INDICATIONS are unavailable.	**Rev 5 Differences** Changed significant transient criteria in accordance with NEI 99-01 Rev 5, FAQ# 39. Removed "approximately" in SA4.1.a to eliminate ambiguity. Created a generalized category list of the equipment required to maintain safety functions in the Basis of HG1.1 (brought forward from basis). Removed "UNPLANNED" from the IC and EAL to be consistent with SS4 (NEI SS6). Plant operations do not allow for the planned removal of > 75% of safety system annunciation and indication while in the hot modes. **Rev 5 Deviations** None

<table>
<tr><th>NEI 99-01 Rev. 5</th><th>BVPS-2 EALs</th><th>Difference or Deviation</th></tr>
<tr><td><u>SU3</u>
Initiating Condition - NOTIFICATION OF UNUSUAL EVENT
UNPLANNED loss of safety system annunciation or indication in the control room for 15 minutes or longer.
Operating Mode Applicability: Power Operation, Startup, Hot Standby, Hot Shutdown
Example Emergency Action Level:
Note: The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.
1. UNPLANNED loss of greater than approximately 75% of the following for 15 minutes or longer:
a. (Site specific control room safety system annunciation)
OR
b. (Site specific control room safety system indication)</td><td><u>SU4</u>
INITIATING CONDITION:
Loss of safety system annunciation or indication in the CONTROL ROOM for 15 minutes or longer.
Operating Mode Applicability: 1, 2, 3, 4
EALs:
Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.
1. Loss of > 75% of EITHER the following for 15 minutes* or longer:
• CONTROL ROOM Annunciator Panels (A1, A2, A4 - A11).
OR
• CONTROL ROOM critical safety function indications (Table S-1).
Table S-1: Critical Safety Functions
• Reactivity Control (ability to shut down the reactor and keep it shut down)
• RCS inventory (ability to cool the core)
• Secondary heat removal (ability to maintain a heat sink)</td><td><u>Rev 5 Differences</u>
Removed "approximately" in SU4.1 to eliminate ambiguity.
Created a generalized category list of the equipment required to maintain safety functions in the Basis of HG1.1 (brought forward from basis).
Removed "UNPLANNED" from the IC and EAL to be consistent with SS4 (NEI SS6). Plant operations do not allow for the planned removal of > 75% of safety system annunciation and indication while in the hot modes.
<u>Rev 5 Deviations</u>
None</td></tr>
<tr><td><u>SU2</u>
Initiating Condition - NOTIFICATION OF UNUSUAL EVENT
Inability to reach required shutdown within Technical Specification limits.
Operating Mode Applicability: Power Operation, Startup, Hot Standby, Hot Shutdown
Example Emergency Action Level:
1. Plant is not brought to required operating mode within Technical Specifications LCO Action Statement Time.</td><td><u>SU5</u>
INITIATING CONDITION:
Inability to reach required operating mode within Technical Specification limits.
Operating Mode Applicability: 1, 2, 3, 4
EALs:
1. Plant is not brought to required operating mode within Technical Specification LCO action statement time.</td><td><u>Rev 5 Differences</u>
Changed "shutdown" to "operating mode" in the IC in accordance with NEI 99-01 Rev 5, FAQ# 30.
<u>Rev 5 Deviations</u>
None</td></tr>
</table>

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
SU6 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Loss of all On-site or Off-site communications capabilities. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** (1 or 2) 1. Loss of all of the following on-site communication methods affecting the ability to perform routine operations. (site specific list of communications methods) 2. Loss of all of the following off-site communication methods affecting the ability to perform offsite notifications. (site specific list of communications methods)	**SU6** **INITIATING CONDITION:** Loss of all ONSITE or OFFSITE communications capabilities. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** 1. Loss of **ALL** of the following ONSITE communication methods affecting the ability to perform routine operations: • Radios. • Plant page. • Plant telephone System (hardwired). **OR** 2. Loss of **ALL** of the following OFFSITE communications methods affecting the ability to perform OFFSITE notifications: • NRC Emergency Notification System – ENS (Red Phone). • NRC Health Physics Network – HPN. • Commercial telephones (hardwired and wireless).	**Rev 5 Differences** None **Rev 5 Deviations** None
SU5 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** RCS leakage. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** (1 or 2) 1. Unidentified or pressure boundary leakage greater than 10 gpm. 2. Identified leakage greater than 25 gpm.	**SU7** **INITIATING CONDITION:** RCS leakage. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** **Note:** • Identified, unidentified and pressure boundary RCS leakage as defined by Technical Specifications. • Relief valve normal operation should be excluded unless it fails to close and cannot be isolated. 1. Unidentified or pressure boundary leakage > **10 gpm**. **OR** 2. Identified leakage > **25 gpm**.	**Rev 5 Differences** Added information to the site specific bases section and a note to the EAL section to specify that the leakage terms were formally defined by Technical Specifications. Added information for relief valve operation from the SU7 (NEI SU6) generic basis to a Note into the EAL. **Rev 5 Deviations** None
SU4 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Fuel Clad degradation. **Operating Mode Applicability:** Power Operation, Startup, Hot Standby, Hot Shutdown **Example Emergency Action Level:** (1 or 2) 1. (Site specific radiation monitor readings indicating fuel clad degradation greater than Technical Specification allowable limits.) 2. (Site specific coolant sample activity value indicating fuel clad degradation greater than Technical Specification allowable limits.)	**SU9** **INITIATING CONDITION:** Fuel clad degradation. **Operating Mode Applicability:** 1, 2, 3, 4 **EALs:** 1. Letdown Monitor (2CHS-RQ101B) > **2.98E+03 µCi/cc**. **OR** 2. RCS activity > **21 µCi/gm** dose equivalent I-131.	**Note:** Monitor high range is 1E-1 to 1E+4 µCi/cc **Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
System Malfunctions - Cold		
CA3 **Initiating Condition - ALERT** Loss of all Off-site and all On-Site AC power to emergency busses for 15 minutes or longer. **Operating Mode Applicability:** Cold Shutdown, Refueling, Defueled **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. Loss of all Off-Site and On-Site AC Power to (site specific emergency busses) for 15 minutes or longer.	**CA1** **INITIATING CONDITION:** Loss of all OFFSITE and all ONSITE AC power to emergency busses for 15 minutes or longer. **Operating Mode Applicability:** 5, 6, D **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. Loss of **ALL** OFFSITE and **ALL** ONSITE AC power to **BOTH** AE and DF 4KV emergency busses for **15 minutes*** or longer.	**Rev 5 Differences** None **Rev 5 Deviations** None
CU3 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** AC power capability to emergency busses reduced to a single power source for 15 minutes or longer such that any additional single failure would result in a station blackout. **Operating Mode Applicability:** Cold Shutdown, Refueling **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. a. AC power capability to (site specific emergency busses) reduced to a single power source for 15 minutes or longer. **AND** b. Any additional singe power source failure will result in a station blackout.	**CU1** **INITIATING CONDITION:** AC power capability to emergency busses reduced to a single source for 15 minutes or longer. **Operating Mode Applicability:** 5, 6 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. a. AC power to AE and DF 4KV emergency busses is reduced to a single power source for **15 minutes*** or longer. **AND** b. Any additional single power source failure will result in loss of **ALL** AC power to **BOTH** AE and DF 4KV emergency busses.	**Rev 5 Differences** Changed IC and EAL terminology for consistency in accordance with NEI 99-01 FAQ# 36. **Rev 5 Deviations** None
CU7 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Loss of required DC power for 15 minutes or longer. **Operating Mode Applicability:** Cold Shutdown, Refueling **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. Less than (site specific bus voltage indication) on required (site specific Vital DC busses) for 15 minutes or longer.	**CU2** **INITIATING CONDITION:** Loss of required DC power for 15 minutes or longer. **Operating Mode Applicability:** 5, 6 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. **< 110.4 VDC** on the required DC busses for **15 minutes*** or longer.	**Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
CU8 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Inadvertent criticality. **Operating Mode Applicability:** Cold Shutdown, Refueling **Example Emergency Action Level:** 1. UNPLANNED sustained positive period observed on nuclear instrumentation. (BWR) 1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation. (PWR)	**CU3** **INITIATING CONDITION:** Inadvertent criticality. **Operating Mode Applicability:** 5, 6 **EALs:** 1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.	**Rev 5 Differences** None **Rev 5 Deviations** None
CU6 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** Loss of all On-site or Off-site communications capabilities. **Operating Mode Applicability:** Cold Shutdown, Refueling, Defueled **Example Emergency Action Level:** (1 or 2) 1. Loss of all of the following on-site communication methods affecting the ability to perform routine operations: (site specific list of communications methods) 2. Loss of all of the following off-site communication methods affecting the ability to perform offsite notifications: (site specific list of communications methods)	**CU6** **INITIATING CONDITION:** Loss of all ONSITE or OFFSITE communications capabilities. **Operating Mode Applicability:** 5, 6, D **EALs:** 1. Loss of **ALL** of the following ONSITE communication methods affecting the ability to perform routine operations: • Radios. • Plant page. • Plant telephone system (hardwired). **OR** 2. Loss of **ALL** of the following OFFSITE communications methods affecting the ability to perform OFFSITE notifications: • NRC Emergency Notification System – ENS (Red Phone). • NRC Health Physics Network – HPN. • Commercial telephones (hardwired and wireless).	**Rev 5 Differences** None **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
<u>CG1</u> **Initiating Condition - GENERAL EMERGENCY** Loss of RCS/RPV inventory affecting fuel clad integrity with containment challenged. **Operating Mode Applicability:** Cold Shutdown, Refueling **Example Emergency Action Level:** (1 or 2) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. a. RCS/RPV level less than (site specific level for TOAF) for 30 minutes or longer. **AND** b. **ANY** containment challenge indication (see Table): 2. a. RCS/RPV level cannot be monitored with core uncovery indicated by **ANY** of the following for 30 minutes or longer. • (Site specific radiation monitor) reading greater than (site specific setpoint). • Erratic source range monitor indication • UNPLANNED level rise in (site specific sump or tank). • *[Other site specific indications]* **AND** b. **ANY** containment challenge indication (see Table): **Table: Containment Challenge Indications** • CONTAINMENT CLOSURE not established. • (Site specific explosive mixture) inside containment. • UNPLANNED rise in containment pressure. • Secondary containment radiation monitor reading above (site specific value). *[BWR only]*	<u>CG7</u> **INITIATING CONDITION:** Loss of RCS inventory affecting fuel clad integrity with containment challenged. **Operating Mode Applicability:** 5, 6 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. a. RCS level **< 56%** RVLIS Full Range (top of active fuel) for **30 minutes*** or longer. **AND** b. **ANY Table C-1** containment challenge indications. **OR** 2. a. RCS level cannot be monitored with core uncovery for **30 minutes*** or longer. **AND** b. Loss of RCS inventory as indicated by **ANY** of the following: • Containment Radiation Monitor (2RMR-RQ206 or 207) **> 15 R/hr.** • Erratic source range monitor indication. • UNPLANNED level rise in Containment sumps or incore instrument sump. **AND** c. **ANY Table C-1** containment challenge indications. **Table C-1: Containment Challenge Indications** • CONTAINMENT CLOSURE not established. • Hydrogen concentration > 4% inside containment. • UNPLANNED rise in containment pressure.	<u>Note:</u> Changes to the nesting format of EAL CG7.2.a is considered administrative. <u>**Rev 5 Differences**</u> Removed the word "reading" CG7.2.b bullet 1 (NEI CG1.2.a bullet 1) for human factors considerations (minimize extraneous words). <u>**Rev 5 Deviations**</u> None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
CS1 **Initiating Condition - SITE AREA EMERGENCY** Loss of RCS/RPV inventory affecting core decay heat removal capability. **Operating Mode Applicability:** Cold Shutdown, Refueling **Example Emergency Action Level:** (1 or 2 or 3) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. With CONTAINMENT CLOSURE not established, RCS/RPV level less than (site specific level). *[6" below the bottom ID of the RCS loop (PWR)]* *[6" below the low-low ECCS actuation setpoint (BWR)]* **OR** 2. With CONTAINMENT CLOSURE established, RCS/RPV level less than (site specific level for TOAF). **OR** 3. RCS/RPV level cannot be monitored for 30 minutes or longer with a loss of RCS/RPV inventory as indicated by **ANY** of the following: • (Site specific radiation monitor) reading greater than (site specific value). • Erratic Source Range Monitor Indication. • Unexplained level rise in (site specific sump or tank).	**CS7** **INITIATING CONDITION:** Loss of RCS inventory affecting core decay heat removal capability. **Operating Mode Applicability:** 5, 6 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. a. CONTAINMENT CLOSURE not established. **AND** b. RCS level **< 64%** RVLIS Full Range (6" below bottom of hot leg). **OR** 2. a. CONTAINMENT CLOSURE established. **AND** b. RCS level **< 56%** RVLIS Full Range (top of active fuel). **OR** 3. a. RCS level cannot be monitored for **30 minutes*** or longer. **AND** b. Loss of RCS inventory as indicated by **ANY** of the following: • Containment Radiation Monitor (2RMR-RQ206 or 207) **> 15 R/hr**. • Erratic source range monitor indication. • UNPLANNED level rise in Containment sumps or incore instrument sump.	**Note:** Changes to the nesting format of EALs CS7.1, CS7.2 and CS7.3 are considered administrative. **Rev 5 Differences** Added wording "Loss of RCS inventory as indicated by" to CS7.3.b to maintain consistency with CA7.1 wording in the escalation pathway. Replaced "unexplained" with "UNPLANNED" in accordance with NEI 99-01 Rev 5, FAQ# 10. **Rev 5 Deviations** None
CA1 **Initiating Condition - ALERT** Loss of RCS/RPV inventory. **Operating Mode Applicability:** Cold Shutdown, Refueling **Example Emergency Action Level:** (1 or 2) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. Loss of RCS/RPV inventory as indicated by level less than (site specific level). *[Low-Low ECCS actuation setpoint / Level 2 (BWR)]* *[Bottom ID of the RCS loop (PWR)]* 2. RCS/RPV level cannot be monitored for 15 minutes or longer with a loss of RCS/RPV inventory as indicated by an unexplained level rise in (site specific sump or tank).	**CA7** **INITIATING CONDITION:** Loss of RCS inventory. **Operating Mode Applicability:** 5, 6 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. Loss of RCS inventory as indicated by **EITHER** of the following: • RVLIS Full Range Level (2RCS-LT1321) **< 65%** (bottom of hot leg). • Refueling Outage Temporary Level Instrument (2RCS-LI102) **≤ 6 inches**. **OR** 2. a. RCS level cannot be monitored for **15 minutes*** or longer. **AND** b. Loss of RCS inventory as indicated by UNPLANNED level rise in Containment sumps or incore instrument sump.	**Note:** Changes to the nesting format of EAL CA7.2 is considered administrative. **Rev 5 Differences** Replaced "unexplained" with "UNPLANNED" in accordance with NEI 99-01 Rev 5, FAQ# 10. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation
CU1 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** RCS leakage. **Operating Mode Applicability:** Cold Shutdown **Example Emergency Action Level:** **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. RCS leakage results in the inability to maintain or restore RPV level greater than (site specific low level RPS actuation setpoint) for 15 minutes or longer. [*BWR*] 1. RCS leakage results in the inability to maintain or restore level within (site specific pressurizer or RCS/RPV level target band) for 15 minutes or longer. [*PWR*]	**CU7** **INITIATING CONDITION:** RCS leakage. **Operating Mode Applicability:** 5 **EALs:** **Notes:** • The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. • Relief valve normal operation should be excluded unless it fails to close and cannot be isolated. 1. RCS leakage results in the inability to maintain or restore RCS level **> Target Level Band** for **15 minutes*** or longer.	**Rev 5 Differences** Added a description of the "Target Level Band" in the basis, which normally is the RCS level band established by site procedures. Added information for relief valve operation from the CU7 (NEI CU1) generic basis to a Note into the EAL. **Rev 5 Deviations** None
CU2 **Initiating Condition - NOTIFICATION OF UNUSUAL EVENT** UNPLANNED loss of RCS/RPV inventory. **Operating Mode Applicability:** Refueling **Example Emergency Action Level:** (1 or 2) **Note:** The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. UNPLANNED RCS/RPV level drop as indicated by either of the following: • RCS/RPV water level drop below the RPV flange for 15 minutes or longer when the RCS/RPV level band is established above the RPV flange. • RCS/RPV water level drop below the RCS level band for 15 minutes or longer when the RCS/RPV level band is established below the RPV flange. 2. RCS/RPV level cannot be monitored with a loss of RCS/RPV inventory as indicated by an unexplained level rise in (site specific sump or tank).	**CU8** **INITIATING CONDITION:** UNPLANNED loss of RCS inventory. **Operating Mode Applicability:** 6 **EALs:** **Note:** The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. 1. UNPLANNED RCS level drop as indicated by **EITHER** of the following: • Refueling Outage Temporary Level Instruments (2RCS-LI102) **< 96 inches** (vessel flange) for **15 minutes*** or longer when the RCS level band is established **__above__** the vessel flange. **OR** • RCS water level drop below the RCS level band for **15 minutes*** or longer when the RCS level band is established **__below__** the vessel flange. **OR** 2. a. RCS level cannot be monitored. **AND** b. Loss of RCS inventory as indicated by UNPLANNED level rise in Containment sumps or incore instrument sump.	**__Note:__** Changes to the nesting format of EAL CU8.2 is considered administrative. **Rev 5 Differences** Replaced "unexplained" with "UNPLANNED" in accordance with NEI 99-01 Rev 5, FAQ# 10. **Rev 5 Deviations** None

NEI 99-01 Rev. 5	BVPS-2 EALs	Difference or Deviation

NEI 99-01 Rev. 5

CA4

Initiating Condition - ALERT

Inability to maintain plant in cold shutdown.

Operating Mode Applicability: Cold Shutdown, Refueling

Example Emergency Action Level: (1 or 2)

1. An UNPLANNED event results in RCS temperature greater than (site specific Technical Specification cold shutdown temperature limit) for greater than the specified duration on table.

Table: RCS Reheat Duration Thresholds		
RCS	**Containment Closure**	**Duration**
Intact (but not RCS Reduced Inventory [PWR])	N/A	60 minutes*
Not Intact or RCS Reduced Inventory (PWR)	Established	20 minutes*
	Not Established	0 minutes
* If an RCS heat removal system is in operation within this time frame and RCS temperature is being reduced, the EAL is not applicable.		

2. An UNPLANNED event results in RCS pressure increase greater than 10 psi due to a loss of RCS cooling. (PWR-This EAL does not apply in Solid Plant conditions.)

BVPS-2 EALs

CA10

INITIATING CONDITION:

Inability to maintain plant in Cold Shutdown.

Operating Mode Applicability: 5, 6

EALs:

Note: Full inventory is pressurizer level ≥ 22% actual with loop stops either isolated or unisolated.

1. RCS temperature **> 200° F** due to an UNPLANNED loss of decay heat removal capability for the greater than the specified duration on **Table C-2**.

Table C-2: RCS Reheat Duration Thresholds		
RCS	**CONTAINMENT CLOSURE**	**Duration**
Intact with Full RCS Inventory	N/A	60 minutes*
Not Intact OR Not Full RCS Inventory	Established	20 minutes*
	Not Established	0 minutes
* If an RCS heat removal system is in operation within this time frame and RCS temperature is being reduced, the EAL is not applicable.		

OR

2. a. RCS temperature cannot be monitored.

   AND

   b. RCS pressure rise **> 10 psi** due to an UNPLANNED loss of decay heat removal capability (this EAL does not apply in RCS solid plant conditions).

Difference or Deviation

Rev 5 Differences

Specified the UNPLANNED event in CA10.1 as being due to an UNPLANNED loss of decay heat removal capability to be consistent with NEI CU4 IC and the change to CA10.2 in accordance with NEI 99-01 Rev 5 FAQ#13.

Added the site specific condition for full inventory to the site specific basis section and as a note in the EAL section.

Reworded CA10.2 in accordance with NEI 99-01 Rev 5, FAQ# 13.

Reworded the first RCS entry condition in Table C-2 to be a positive statement. Reworded the second condition for consistency with the wording in the first condition. These changes are considered administrative.

Rev 5 Deviations

The conditional statement "RCS temperature cannot be monitored" was added as a condition to CA10.2. This is consistent with the basis of CA4 in the proposed NEI 99-01, Rev 6.

NEI 99-01 Rev. 5

CU4

Initiating Condition - NOTIFICATION OF UNUSUAL EVENT

UNPLANNED loss of decay heat removal capability with irradiated fuel in the RPV.

Operating Mode Applicability: Cold Shutdown, Refueling

Example Emergency Action Level: (1 or 2)

Note: The Emergency Director should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. UNPLANNED event results in RCS temperature exceeding the Technical Specification cold shutdown temperature limit.
2. Loss of all RCS temperature and RCS/RPV level indication for 15 minutes or longer.

BVPS-2 EALs

CU10

INITIATING CONDITION:

UNPLANNED Loss of decay heat removal capability.

Operating Mode Applicability: 5, 6

EALs:

Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

1. RCS temperature **> 200° F** due to an UNPLANNED loss of decay heat removal capability.

   OR

2. Loss of **ALL** RCS temperature and RCS level indication for **15 minutes*** or longer.

Difference or Deviation

Rev 5 Differences

Removed "with irradiated fuel in reactor vessel" from IC in accordance with NEI 99-01 Rev 5, FAQ#11.

Specified the UNPLANNED event in CU10.1 as being due to an UNPLANNED loss of decay heat removal capability to be consistent with NEI CU4 IC and the change to BVPS-2 CA10.2 in accordance with NEI 99-01 Rev 5 FAQ#13.

Rev 5 Deviations

None

Appendix 6
L-11-320

Proposed Beaver Valley Power Station Unit Nos. 1 and 2 EAL Wallboards
(Four pages follow)

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
1 Security	HG1 HOSTILE ACTION resulting in loss of physical control of the facility.	HS1 HOSTILE ACTION within the PROTECTED AREA.	HA1 HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat.	HU1 Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant.
2 CR Evacuation		HS2 Control Room evacuation has been initiated and plant control cannot be established.	HA2 Control Room evacuation has been initiated.	
3 Natural or Destructive Phenomena	* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. Table H-1		HA3 Natural or destructive phenomena affecting VITAL AREAS.	HU3 Natural or destructive phenomena affecting the PROTECTED AREA.
4 FIRE / EXPLOSION	Table H-1		HA4 FIRE or EXPLOSION affecting the operability of plant safety systems required to establish or maintain safe shutdown.	HU4 FIRE within the PROTECTED AREA not extinguished within 15 minutes of detection or EXPLOSION within the PROTECTED AREA.
5 Toxic Gas			HA5	HU5
6 EMERGENCY DIRECTOR Judgment	HG6 Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of GENERAL EMERGENCY.	HS6 Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of SITE AREA EMERGENCY.	HA6 Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an ALERT.	HU6 Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an UNUSUAL EVENT.

DRY FUEL STORAGE FACILITY

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
E 1 Dry Fuel Storage	* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.			E-HU1 NOT APPLICABLE Damage to a loaded cask CONFINEMENT BOUNDARY. EALs: 1. Damage to a loaded cask CONFINEMENT BOUNDARY.

RADIOLOGICAL EFFLUENT / ABNORMAL RADIATION LEVELS

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
1 Radiological Effluent	RG1	RS1	RA1	RU1
2 Abnormal Radiation Levels	* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.		RA2	RU2 UNPLANNED rise in plant radiation levels.
3			RA3 Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions. EALs: 1. Dose rate > 15 mR/hr in ANY of the following areas requiring continuous occupancy to maintain plant safety functions: • Control Room • Central Alarm Station • Secondary Alarm Station	

SYSTEM MALFUNCTIONS - HOT

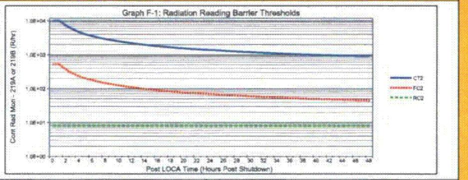
	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
1 Loss of AC Power	SG1	SS1	SA1	SU1
2 Loss of DC Power		SS2 Loss of all vital DC power for 15 minutes or longer.		
3 Failure of RPS	SG3	SS3	SA3	SU3 Inadvertent criticality.
4 Annunciators	Table S-1: Critical Safety Functions; Table S-2: Significant Transients	SS4	SA4	SU4
5 T.S. Limits				SU5
6 Communications	* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.			SU6 Loss of all onsite or offsite communications capabilities.
7 RCS Leakage				SU7 RCS leakage.
9 Fuel Clad Degradation				SU9 Fuel clad degradation.

FISSION PRODUCT BARRIER DEGRADATION

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
FG1 1. Loss of any two barriers and loss or potential loss of the third barrier.	FS1 1. Loss or potential loss of any two barriers.	FA1 1. Any loss or any potential loss of either fuel clad or RCS.	FU1 1. Any loss or any potential loss of containment.

FPB Identifier
XXX
Barrier Abreviation (FC, RC, or CT) — Sub Category (1-10)

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.



	FC - FUEL CLAD		RC - REACTOR COOLANT SYSTEM		CT - CONTAINMENT	
Sub-Category	Loss	Potential Loss	Loss	Potential Loss	Loss	Potential Loss
1. Critical Safety Function Status	1. Core Cooling - Red entry conditions met.	1. Core Cooling - Orange entry conditions met. OR 2. a. Heat Sink - Red entry conditions met. AND b. Heat Sink is required.		1. RCS Integrity - Red entry conditions met. OR 2. a. Heat Sink - Red entry conditions met. AND b. Heat Sink is required.		1. Containment - Red entry conditions met.
2. Containment Rad Monitoring	1. Containment Radiation Monitor		1. Containment Radiation Monitor			1. Containment Radiation Monitor
3. Core Temperature						
4. RCS Level		1. RCS level < Table F-1.				
5. RCS Leak Rate						
6. SG Tube Leakage / Rupture						
7. RCS Activity						
8. Containment Pressure						
9. Containment Isolation Failure					1. a. Failure of ALL valves in any one line to close. AND b. Direct downstream pathway to the environment exists after containment isolation signal.	
10. EMERGENCY DIRECTOR Judgment	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the fuel clad barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the fuel clad barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the RCS barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the RCS barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the containment barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the containment barrier.

Beaver Valley Unit 1
HOT EAL WALL BOARD
Revision 00
EAL Technical Basis Manual

FirstEnergy

WALL BOARDS FOR "INFORMATION ONLY"

EAL Identifier
XXX.X
Category (R,H,E,S,F,C) — Sequential number within subcategory/classification
Emergency classification (G,S,A,U) — Subcategory number (1 if no subcategory)

BEAVER VALLEY UNIT 1

Modes: 1 Power Operation >5% Rx Power; 2 Startup ≤ 5% Rx Power; 3 Hot Standby ≥ 350°F; 4 Hot Shutdown >200°F; 5 Cold Shutdown ≤ 200°F; 6 Refueling; D Defueled

COLD MODE EALs (RCS ≤ 200°F) BEAVER VALLEY UNIT 1 COLD MODE EALs (RCS ≤ 200°F)

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT	
1 Security	**HG1** 1 2 3 4 5 6 D HOSTILE ACTION resulting in loss of physical control of the facility. **EALs:** 1. A HOSTILE ACTION has occurred such that plant personnel are unable to operate equipment required to maintain safety functions listed below: • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink) OR 2. A HOSTILE ACTION has caused failure of spent fuel cooling systems and IMMINENT fuel damage is likely.	**HS1** 1 2 3 4 5 6 D HOSTILE ACTION within the PROTECTED AREA. **EALs:** 1. A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the Security Shift Supervisor.	**HA1** 1 2 3 4 5 6 D HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat. **EALs:** 1. A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the Security Shift Supervisor. OR 2. A validated notification from the NRC of a LARGE AIRCRAFT attack threat within **30 minutes** of the site.	**HU1** 1 2 3 4 5 6 D Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant. **EALs:** 1. A SECURITY CONDITION that does not involve a HOSTILE ACTION as reported by the Security Shift Supervisor. OR 2. A credible site specific security threat notification. OR 3. A validated notification from the NRC providing information of a LARGE AIRCRAFT threat.	Security 1
2 CR Evacuation		**HS2** 1 2 3 4 5 6 D Control Room evacuation has been initiated and plant control cannot be established. **EALs:** 1. a. Control Room evacuation has been initiated. AND b. Control of ANY of the following safety functions is not established from an alternate location within **15 minutes**. • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink)	**HA2** 1 2 3 4 5 6 D Control Room evacuation has been initiated. **EALs:** 1. Control Room evacuation has been initiated.		CR Evacuation 2
3 Natural or Destructive Phenomena	* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. Table H-1: • Cable Tunnel (CV-3) • Control Room • Containment Building • Demin. Water Storage Tank (1WT-TK-10) • Diesel Generator Building • Fuel Building • Intake Structure Pump Cubicles • Safeguards (including AFW, Main Steam and Cable Vault Areas) • Primary Auxiliary Building (except elev. 768') • RWST (1QS-TK-1) • Service Building (below elev. 735')		**HA3** 1 2 3 4 5 6 D Natural or destructive phenomena affecting VITAL AREAS. [illegible]	**HU3** 1 2 3 4 5 6 D Natural or destructive phenomena affecting the PROTECTED AREA. [illegible]	Natural or Destructive Phenomena 3
4 FIRE / EXPLOSION	Table H-1: • Cable Tunnel (CV-3) • Control Room • Containment Building • Demin. Water Storage Tank (1WT-TK-10) • Diesel Generator Building • Fuel Building • Intake Structure Pump Cubicles • Safeguards (including AFW, Main Steam and Cable Vault Areas) • Primary Auxiliary Building (except elev. 768') • RWST (1QS-TK-1) • Service Building (below elev. 735')		**HA4** 1 2 3 4 5 6 D FIRE or EXPLOSION affecting the operability of plant safety systems required to establish or maintain safe shutdown. [illegible]	**HU4** 1 2 3 4 5 6 D FIRE within the PROTECTED AREA not extinguished within 15 minutes of detection or EXPLOSION within the PROTECTED AREA. [illegible] 2. EXPLOSION within the PROTECTED AREA.	FIRE / EXPLOSION 4
5 Toxic Gas			**HA5** 1 2 3 4 5 6 D [illegible]	**HU5** 1 2 3 4 5 6 D [illegible]	Toxic Gas 5
6 EMERGENCY DIRECTOR Judgment	**HG6** 1 2 3 4 5 6 D Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of GENERAL EMERGENCY. **EALs:** 1. [illegible] HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA Protective Action Guide exposure levels offsite for more than the immediate site area.	**HS6** 1 2 3 4 5 6 D Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of a SITE AREA EMERGENCY. **EALs:** 1. [illegible] damage or malicious acts: (1) toward site personnel or equipment that could lead to the likely failure of or, (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA Protective Action Guide exposure levels beyond the site boundary.	**HA6** 1 2 3 4 5 6 D Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an ALERT. **EALs:** 1. [illegible] to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA Protective Action Guide exposure levels.	**HU6** 1 2 3 4 5 6 D Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an UNUSUAL EVENT. **EALs:** 1. [illegible] No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs.	EMERGENCY DIRECTOR Judgment 6

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

SYSTEM MALFUNCTIONS - COLD

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT	
1 Loss of AC Power	* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.		**CA1** 5 6 D Loss of all offsite and all onsite AC power to emergency busses for 15 minutes or longer. **EALs:** 1. Loss of ALL offsite and ALL onsite AC power to BOTH AE and DF 4KV emergency busses for **15 minutes*** or longer.	**CU1** 5 6 AC power capability to emergency busses reduced to a single source for 15 minutes or longer. **EALs:** 1. a. AC power to AE and DF 4KV emergency busses is reduced to a single source for **15 minutes*** or longer. AND b. Any additional single power source failure will result in loss of ALL AC power to BOTH AE and DF 4KV emergency busses.	Loss of AC Power 1
2 Loss of DC Power				**CU2** 5 6 Loss of required DC power for 15 minutes or longer. **EALs:** 1. Bus voltage indication on the required DC busses less than the following for **15 minutes*** or longer: • **< 110.4 VDC** on Bus 1-1 or Bus 1-2 • **< 110.0 VDC** on Bus 1-3 or Bus 1-4	Loss of DC Power 2
3 Failure of RPS				**CU3** 5 6 Inadvertent criticality. **EALs:** 1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.	Failure of RPS 3
6 Communications				**CU6** 5 6 D Loss of all onsite or offsite communications capabilities. **EALs:** 1. Loss of ALL of the following onsite communication methods affecting the ability to perform routine operations: [illegible]	Communications 6
7 RCS Leakage	**CG7** 5 6 Loss of RCS inventory affecting fuel clad integrity with containment challenged. [illegible] Table C-1: Containment Challenge Indications • CONTAINMENT CLOSURE not established. • Hydrogen concentration > 4% inside containment. • UNPLANNED rise in containment pressure.	**CS7** 5 6 Loss of RCS inventory affecting core decay heat removal capability. [illegible]	**CA7** 5 6 Loss of RCS inventory. [illegible]	**CU7** 5 RCS leakage. [illegible] **CU8** 5 6 UNPLANNED loss of RCS inventory. [illegible]	RCS Leakage 7 8
10 Heat Sink		Table C-2: RCS Reheat Duration Thresholds [illegible]	**CA10** 5 6 Inability to maintain plant in cold shutdown. [illegible]	**CU10** 5 6 UNPLANNED loss of decay heat removal capability. [illegible]	Heat Sink 10

SYSTEM MALFUNCTIONS - COLD

DRY FUEL STORAGE FACILITY

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT	
E 1 Dry Fuel Storage Facility	* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.			**E-HU1** NOT APPLICABLE Damage to a loaded cask CONFINEMENT BOUNDARY. **EALs:** 1. Damage to a loaded cask CONFINEMENT BOUNDARY.	Dry Fuel Storage Facility 1 E

DRY FUEL STORAGE FACILITY

RADIOLOGICAL EFFLUENT / ABNORMAL RADIATION LEVELS

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT	
R 1 Radiological Effluent	**RG1** 1 2 3 4 5 6 D Offsite dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology. [illegible]	**RS1** 1 2 3 4 5 6 D Offsite dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 100 mRem TEDE or 500 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology. [illegible]	**RA1** 1 2 3 4 5 6 D Any release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM limit for 15 minutes or longer. [illegible]	**RU1** 1 2 3 4 5 6 D Any release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes or longer. [illegible]	Radiological Effluent 1 R
2 Abnormal Radiation Levels	* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.		**RA2** 1 2 3 4 5 6 D [illegible]	**RU2** 1 2 3 4 5 6 D UNPLANNED rise in plant radiation levels. [illegible]	Abnormal Radiation Levels 2
3			**RA3** 1 2 3 4 5 6 D Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions. **EALs:** 1. Dose rate **> 15 mR/hr** in **ANY** of the following areas requiring continuous occupancy to maintain plant safety functions: • Control Room • Central Alarm Station • Secondary Alarm Station		3

RADIOLOGICAL EFFLUENT / ABNORMAL RADIATION LEVELS

DEFINITIONS

The terms defined in this section are those which are used in special context in this document and/or are unique to the Beaver Valley Power Station (BVPS).

AFFECTING SAFE SHUTDOWN – Event in progress has adversely affected functions that are necessary to bring the plant to and maintain it in the applicable Hot or Cold Shutdown condition. Plant condition applicability is determined by Technical Specification LCOs in effect.

Example 1: Event causes damage that results in entry into an LCO that requires the plant to be placed in Hot Shutdown. Hot Shutdown is achievable, but Cold Shutdown is not. This event is not "AFFECTING SAFE SHUTDOWN."

Example 2: Event causes damage that results in entry into an LCO that requires the plant to be placed in Cold Shutdown. Hot Shutdown is achievable, but Cold Shutdown is not. This event is "AFFECTING SAFE SHUTDOWN."

BOMB – An explosive device suspected of having sufficient force to damage plant systems or structures.

CIVIL DISTURBANCE – A group of persons violently protesting station operations or activities at the site. This event does not involve HOSTILE ACTIONs. Peaceful demonstrations are not CIVIL DISTURBANCES.

COMPENSATORY INDICATIONS – Computer points, In-Plant Computer - IPC (U1), Inadequate Core Cooling Monitor - ICCM (U1), Sequence of Events Recorder - SER (U1), Plant Computer System - PCS (U2), Plant Safety Monitoring System - PSMS (U2) and Pi Data (ProcessBook®).

CONFINEMENT BOUNDARY – The barrier(s) between areas containing radioactive substances and the environment.

CONTAINMENT CLOSURE – The procedurally defined actions taken to secure primary containment and its associated structures, systems, and components as a functional barrier to fission product release under existing plant conditions.

EMERGENCY ACTION LEVEL (EAL) – A pre-determined, site specific, observable threshold for a plant IC that places the plant in a given EMERGENCY CLASSIFICATION LEVEL. An EAL can be: an instrument reading; an equipment status indicator; a measurable parameter (on-site or off-site); a discrete, observable event; results of analyses; entry into specific emergency operating procedures; or another phenomenon which, if it occurs, indicates entry into a particular EMERGENCY CLASSIFICATION LEVEL.

EMERGENCY CLASSIFICATION LEVEL (ECL) – One of a minimum set of names or titles established by the NRC for grouping off normal nuclear power plant conditions according to (1) their relative radiological seriousness, and (2) the time-sensitive onsite and offsite radiological emergency preparedness actions necessary to respond to such conditions. The existing radiological EMERGENCY CLASSIFICATION LEVELS, in ascending order of seriousness, are called:

- UNUSUAL EVENT – Events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to the facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs.
- ALERT – Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA Protective Action Guide exposure levels.
- SITE AREA EMERGENCY – Events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts; 1) toward site personnel or equipment that could lead to the likely failure of or; 2) that prevent effective access to, equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA Protective Action Guide exposure levels beyond the site boundary.
- GENERAL EMERGENCY – Events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA Protective Action Guide exposure levels offsite for more than the immediate site area.

EXPLOSION – A rapid, violent, unconfined combustion, or catastrophic failure of pressurized/energized equipment that imparts energy of sufficient force to potentially damage permanent structures, systems, or components.

EXTORTION – An attempt to cause an action at the station by threat of force.

FAULTED – In a steam generator, the existence of secondary side leakage that results in an uncontrolled drop in steam generator pressure or the steam generator being completely depressurized.

FIRE – Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute FIRE. Observation of flame is preferred but is not required if large quantities of smoke and heat are observed.

HOSTAGE – A person(s) held as leverage against the station to ensure that demands will be met by the station.

HOSTILE ACTION – An act toward a nuclear power plant or its personnel that includes the use of violent force to destroy equipment, take HOSTAGES, and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, PROJECTILES, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. HOSTILE ACTION should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on the nuclear power plant. Non-terrorism-based EALs should be used to address such activities (i.e., violent acts between individuals in the OWNER CONTROLLED AREA).

IMMINENT / IMPENDING – Means about to happen (generally within 30 minutes).

INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI) – A complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage.

INTRUDER / INTRUSION – A person(s) present in a specified area without authorization. Discovery of a BOMB in a specified area is indication of INTRUSION into that area by a HOSTILE FORCE.

LARGE AIRCRAFT – Any size or type of aircraft with the potential for causing significant damage to the plant (refer to the Security Plan for a more detailed definition).

NORMAL LEVELS – The highest reading in the past twenty-four hours excluding the current peak value.

NORMAL PLANT OPERATIONS – Activities at the plant site associated with routine testing, maintenance, or equipment operations, in accordance with normal operating or administrative procedures. Entry into abnormal or emergency operating procedures, or deviation from normal security or radiological controls posture, is a departure from NORMAL PLANT OPERATIONS.

OWNER CONTROLLED AREA – The property associated with the station and owned by the company. Access is normally limited to persons entering for official business.

PROJECTILE – Means a fired, projected object, such as a bullet or pellet having no capacity for self propulsion directed towards a nuclear power plant that could cause concern for its continued operability, reliability or personnel safety.

PROTECTED AREA – Means an area encompassed by physical barriers and to which access is controlled.

RUPTURED – In a steam generator, existence of primary-to-secondary leakage of a magnitude sufficient to require or cause a reactor trip and safety injection.

SABOTAGE – Deliberate damage, mis-alignment, or mis-operation of plant equipment with the intent to render the equipment inoperable. Equipment found tampered with or damaged due to malicious mischief may not meet the definition of SABOTAGE until this determination is made by security supervision.

SECURITY CONDITION – Any Security Event as listed in the approved security contingency plan that constitutes a threat/compromise to site security, threat/risk to site personnel, or a potential degradation to the level of safety of the plant. A SECURITY CONDITION does not involve a HOSTILE ACTION.

STRIKE ACTION – A work stoppage within the protected area by a body of workers to enforce compliance with demands made on management. The STRIKE ACTION must threaten to interrupt NORMAL PLANT OPERATIONS.

UNAFFECTED AREA – Any area or location which is known to be not significantly affected by radiation levels or other hazardous conditions.

UNISOLABLE – A breach or leak that cannot be promptly isolated.

UNPLANNED – A parameter change or an event, the reasons for which may be known or unknown, that is not the result of an intended evolution or expected plant response to a transient.

VALID – An indication, report, or condition, is considered to be VALID when it is verified by (1) an instrument channel check, (2) indications on related or redundant indications, or (3) by direct observation by plant personnel, such that doubt related to the indicator's operability, the condition's existence, or the report's accuracy is removed. Implicit in this definition is the need for timely assessment.

VISIBLE DAMAGE – Damage to equipment or structure that is readily observable without measurements, testing, or analysis. Damage is sufficient to cause concern regarding the continued availability or reliability of the affected structure, system, or component. Example damage includes: deformation due to heat or impact, denting, penetration, rupture, cracking, and paint blistering. Surface blemishes (e.g., paint chipping, scratches) should not be included.

VITAL AREA – Means any area that contains VITAL EQUIPMENT.

VITAL EQUIPMENT – Means any equipment, system, device, or material, the failure, destruction, or release of which could directly or indirectly endanger the public health and safety by exposure to radiation. Equipment or systems which would be required to function to protect public health and safety following such failure, destruction, or release are also considered to be vital.

BEAVER VALLEY UNIT 1

BEAVER VALLEY UNIT 1

Beaver Valley Unit 1
COLD EAL WALL BOARD
Revision 00
EAL Technical Basis Manual

FirstEnergy

WALL BOARDS FOR "INFORMATION ONLY"

EAL Identifier

XXX.X

Category (R,H,E,S,F,C) — Emergency classification (G,S,A,U) — Subcategory number (1 if no subcategory) — Sequential number within subcategory/classification

BEAVER VALLEY UNIT 1

Modes: 1 Power Operation >5% Rx Power; 2 Startup ≤ 5% Rx Power; 3 Hot Standby ≥ 350°F; 4 Hot Shutdown >200°F; 5 Cold Shutdown ≤ 200°F; 6 Refueling; D Defueled

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY (H)

1 Security

GENERAL EMERGENCY – HG1
HOSTILE ACTION resulting in loss of physical control of the facility.

EALs:
1. A HOSTILE ACTION has occurred such that plant personnel are unable to operate equipment required to maintain safety functions listed below:
   - Reactivity Control (ability to shut down the reactor and keep it shut down)
   - RCS inventory (ability to cool the core)
   - Secondary heat removal (ability to maintain a heat sink)

   OR
2. A HOSTILE ACTION has caused failure of spent fuel cooling systems and IMMINENT fuel damage is likely.

SITE AREA EMERGENCY – HS1
HOSTILE ACTION within the PROTECTED AREA.

EALs:
1. A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the Security Shift Supervisor.

ALERT – HA1
HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat.

EALs:
1. A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the Security Shift Supervisor.

   OR
2. A validated notification from the NRC of a LARGE AIRCRAFT attack threat within 30 minutes of the site.

UNUSUAL EVENT – HU1
Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant.

EALs:
1. A SECURITY CONDITION that does not involve a HOSTILE ACTION as reported by the Security Shift Supervisor.

   OR
2. A credible site specific security threat notification.

   OR
3. A validated notification from the NRC providing information of a LARGE AIRCRAFT threat.

2 CR Evacuation

SITE AREA EMERGENCY – HS2
Control Room evacuation has been initiated and plant control cannot be established.

EALs:
1. a. Control Room evacuation has been initiated.

   AND

   b. Control of ANY of the following safety functions is not established from an alternate location within 15 minutes.
   - Reactivity Control (ability to shut down the reactor and keep it shut down)
   - RCS inventory (ability to cool the core)
   - Secondary heat removal (ability to maintain a heat sink)

ALERT – HA2
Control Room evacuation has been initiated.

EALs:
1. Control Room evacuation has been initiated.

3 Natural or Destructive Phenomena

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

Table H-1
Cable Vault and Rod Control Bldg
Containment Building
Control Building
Demin. Water Storage (2FWE-TK210)
Diesel Generator Building
Fuel Handling Building
Intake Structure Pump Cubicles
Main Steam Valve Room
Primary Aux. Building (except elev. 773')
RWST (2QSS-TK21)
Safeguards Building
Service Building (except FW Reg Vlv Rm)

ALERT – HA3
Natural or destructive phenomena affecting VITAL AREAS.

EALs:
1. a. Seismic event > 0.06g (OBE) acceleration (as indicated by lit lamp on 2ERS-CCC-1 Seismic Instrumentation Central Control Cabinet).

   AND

   b. Earthquake confirmed by ANY of the following:
   - Earthquake felt in plant.
   - National Earthquake Center.
   - Control Room indication of degraded performance of systems required for the safe shutdown of the plant.

   OR
2. Tornado or high winds > 80 mph resulting in EITHER of the following:
   - VISIBLE DAMAGE to ANY structures in Table H-1 areas containing safety systems or components.
   - Control Room indication of degraded performance of those safety systems.

   OR
3. Internal flooding in Table H-1 areas resulting in EITHER of the following:
   - Electrical shock hazard that precludes access to operate or monitor safety equipment.
   - Control room indication of degraded performance of those safety systems.

   OR
4. High river level > 705 feet MSL resulting in EITHER of the following:
   - VISIBLE DAMAGE to ANY structures in Table H-1 areas containing safety systems or components.
   - Control Room indication of degraded performance of those safety systems.

   OR
5. Low river level (LR-1CW-101) < 650 feet MSL resulting in Control Room indication of degraded performance of safety systems located in Table H-1 areas.

   OR
6. Turbine failure-generated PROJECTILES resulting in EITHER of the following:
   - VISIBLE DAMAGE to or penetration of ANY structures in Table H-1 areas containing safety systems or components.
   - Control Room indication of degraded performance of those safety systems.

   OR
7. Vehicle crash resulting in EITHER of the following:
   - VISIBLE DAMAGE to ANY structures in Table H-1 areas containing safety systems or components.
   - Control Room indication of degraded performance of those safety systems.

UNUSUAL EVENT – HU3
Natural or destructive phenomena affecting the PROTECTED AREA.

EALs:
1. a. Seismic event > 0.01g acceleration (as indicated by initiation of the Accelerograph Recording System on Ann A10-5H, Init of Seismic Exceed Preset and/or Spectral Accelerations).

   AND

   b. Earthquake confirmed by EITHER of the following:
   - Earthquake felt in plant.
   - National Earthquake Center.

   OR
2. a. Tornado within the PROTECTED AREA.

   OR

   b. High winds > 98 mph.

   OR
3. Internal flooding in Table H-1 areas that has the potential to affect safety related equipment required by Technical Specifications for the current operating mode.

   OR
4. High river water level > 705 feet MSL.

   OR
5. Low river water level (LR-1CW-101) < 650 feet MSL.

   OR
6. Turbine failure resulting in casing penetration or damage to turbine or generator seals.

4 FIRE / EXPLOSION

ALERT – HA4
FIRE or EXPLOSION affecting the operability of plant safety systems required to establish or maintain safe shutdown.

EALs:
1. FIRE or EXPLOSION resulting in EITHER of the following:
   - VISIBLE DAMAGE to ANY structures in Table H-1 areas containing safety systems or components.
   - Control Room indication of degraded performance of those safety systems.

UNUSUAL EVENT – HU4
FIRE within the PROTECTED AREA not extinguished within 15 minutes of detection or EXPLOSION within the PROTECTED AREA.

EALs:
Note: Immediately adjacent to applies to FIRES that directly impact or obstruct the areas of concern.
1. FIRE not extinguished within 15 minutes* of Control Room notification or verification of a Control Room FIRE alarm in actual contact with or immediately adjacent to ANY of the Table H-1 areas.

   OR
2. EXPLOSION within the PROTECTED AREA.

5 Toxic Gas

ALERT – HA5
Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of operable equipment required to maintain safe operations or safely shutdown the reactor.

EALs:
Notes:
- If the equipment in the stated area was already inoperable, or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event.
- This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area.
1. Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of systems required to maintain safe operations or safely shutdown the reactor.

UNUSUAL EVENT – HU5
Release of toxic, corrosive, asphyxiant or flammable gases deemed detrimental to NORMAL PLANT OPERATIONS.

EALs:
Note: This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area.
1. Toxic, corrosive, asphyxiant or flammable gases in amounts that have or could adversely affect NORMAL PLANT OPERATIONS.

   OR
2. Report by local, county or state officials for evacuation or sheltering of site personnel based on an offsite event.

6 EMERGENCY DIRECTOR Judgment

GENERAL EMERGENCY – HG6
Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of GENERAL EMERGENCY.

EALs:
1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA Protective Action Guide exposure levels offsite for more than the immediate site area.

SITE AREA EMERGENCY – HS6
Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of SITE AREA EMERGENCY.

EALs:
1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts: (1) toward site personnel or equipment that could lead to the likely failure of or; (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA Protective Action Guide exposure levels beyond the site boundary.

ALERT – HA6
Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an ALERT.

EALs:
1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA Protective Action Guide exposure levels.

UNUSUAL EVENT – HU6
Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an UNUSUAL EVENT.

EALs:
1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs.

DRY FUEL STORAGE FACILITY (E)

1 Dry Fuel Storage Facility

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

UNUSUAL EVENT – E-HU1 (NOT APPLICABLE)
Damage to a loaded cask CONFINEMENT BOUNDARY.

EALs:
1. Damage to a loaded cask CONFINEMENT BOUNDARY.

RADIOLOGICAL EFFLUENT / ABNORMAL RADIATION LEVELS (R)

1 Radiological Effluent

GENERAL EMERGENCY – RG1
Offsite dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology.

EALs:
Note: If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results.
1. The following gaseous effluent monitor greater than the reading shown for 15 minutes* or longer:
   - SLCRS Vent (2HVS-RQ109E) ..... 1.95E+07 μCi/sec

   OR
2. Dose assessment using actual meteorogy indicates doses at or beyond the site boundary of EITHER of the following:
   - > 1000 mRem TEDE.
   - > 5000 mRem CDE Child Thyroid.

   OR
3. Field survey results at or beyond the site boundary indicate EITHER of the following:
   - Gamma (closed window) dose rate > 1000 mR/hr for 60 minutes* or longer.
   - Air sample analysis > 5000 mRem CDE Child Thyroid for one hour of inhalation.

SITE AREA EMERGENCY – RS1
Offsite dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 100 mRem TEDE or 500 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology.

EALs:
Note: If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results.
1. ANY of the following gaseous effluent monitors greater than the reading shown for 15 minutes* or longer:
   - SLCRS Vent (2HVS-RQ109E) ..... 1.95E+06 μCi/sec
   - Ventilation Vent (2HVS-RQ101B) ... 1.67E-01 μCi/cc

   OR
2. Dose assessment using actual meteorogy indicates doses at or beyond the site boundary of EITHER of the following:
   - > 100 mRem TEDE.
   - > 500 mRem CDE Child Thyroid.

   OR
3. Field survey results at or beyond the site boundary indicate EITHER of the following:
   - Gamma (closed window) dose rate > 100 mR/hr for 60 minutes* or longer.
   - Air sample analysis > 500 mRem CDE Child Thyroid for one hour of inhalation.

ALERT – RA1
Any release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM limit for 15 minutes or longer.

EALs:
Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.
1. ANY of the following gaseous effluent monitors greater than the reading shown for 15 minutes or longer:
   - SLCRS Vent (2HVS-RQ109E) ..... 5.88E+05 μCi/sec
   - Ventilation Vent (2HVS-RQ101B) ... 6.02E-02 μCi/cc

   OR
2. Liquid Waste Effluent Monitor (2SGC-RQ100) > 200 times the High alarm setpoint, not to exceed 4.5E-02 μCi/cc, established by a current radioactivity discharge permit for 15 minutes or longer.

   OR
3. Confirmed sample analysis for gaseous or liquid releases > 200 times the ODCM limit for 15 minutes or longer.

UNUSUAL EVENT – RU1
Any release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes or longer.

EALs:
Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.
1. ANY of the following gaseous effluent monitors greater than the reading shown for 60 minutes or longer:
   - SLCRS Vent (2HVS-RQ109E) ..... 5.88E+03 μCi/sec
   - Ventilation Vent (2HVS-RQ101B) ... 6.02E-04 μCi/cc

   OR
2. Liquid Waste Effluent Monitor (2SGC-RQ100) > 2 times the High alarm setpoint established by a current radioactivity discharge permit for 60 minutes or longer.

   OR
3. Confirmed sample analysis for gaseous or liquid releases > 2 times the ODCM limit for 60 minutes or longer.

2 Abnormal Radiation Levels

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

ALERT – RA2
Damage to irradiated fuel or loss of water level that has resulted or will result in the uncovering of irradiated fuel outside the reactor vessel.

EALs:
1. A water level drop in the spent fuel pool, transfer tube or reactor cavity that will result in irradiated fuel becoming uncovered.

   OR
2. > 1000 mR/hr reading on ANY of the following due to damage to irradiated fuel or loss of water level:
   - Manipulator Crane (2RMR-RQ203)
   - Fuel Pit Bridge (2RMF-RQ202)

UNUSUAL EVENT – RU2
UNPLANNED rise in plant radiation levels.

EALs:
1. a. UNPLANNED water level drop in the spent fuel pool, transfer canal or reactor cavity as indicated by level < Tech Spec Minimum (23 feet).

   AND

   b. Area radiation monitor rise resulting in a High alarm on ANY of the following:
   - Manipulator Crane (2RMR-RQ203)
   - Fuel Pit Bridge (2RMF-RQ202)

   OR
2. UNPLANNED area radiation monitor or radiation survey > 1000 times NORMAL LEVELS.

3

ALERT – RA3
Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions.

EALs:
1. Dose rate > 15 mR/hr in ANY of the following areas requiring continuous occupancy to maintain plant safety functions:
   - Control Room
   - Central Alarm Station
   - Secondary Alarm Station

SYSTEM MALFUNCTIONS - HOT (S)

1 Loss of AC Power

GENERAL EMERGENCY – SG1
Prolonged loss of all offsite and all onsite AC power to emergency busses.

EALs:
1. a. Loss of ALL offsite and ALL onsite AC power to BOTH AE and DF 4KV emergency busses.

   AND

   b. EITHER of the following:
   - Restoration of EITHER the AE 4KV emergency bus OR DF 4KV emergency bus with 4 hours is not likely.
   - Core Cooling - Red entry conditions met.

SITE AREA EMERGENCY – SS1
Loss of all offsite and all onsite AC power to emergency busses for 15 minutes or longer.

EALs:
Note: Credit cannot be taken for emergency busses being powered from the other unit's emergency diesel generators.
1. Loss of ALL offsite and ALL onsite AC power to BOTH AE and DF 4KV emergency busses for 15 minutes* or longer.

ALERT – SA1
AC power capability to emergency busses reduced to a single source for 15 minutes or longer.

EALs:
1. a. AC power to AE and DF 4KV emergency busses is reduced to a single power source for 15 minutes* or longer.

   AND

   b. Any additional single power source failure will result in loss of ALL AC power to BOTH AE and DF 4KV emergency busses.

UNUSUAL EVENT – SU1
Loss of all offsite AC power to emergency busses for 15 minutes or longer.

EALs:
1. Loss of ALL offsite AC power to BOTH AE and DF 4KV emergency busses for 15 minutes* or longer.

2 Loss of DC Power

SITE AREA EMERGENCY – SS2
Loss of all vital DC power for 15 minutes or longer.

EALs:
1. < 110.4 VDC on ALL safety related DC busses (2-1, 2-2, 2-3 and 2-4) for 15 minutes* or longer.

3 Failure of RPS

GENERAL EMERGENCY – SG3
Automatic trip and all manual actions failed to shutdown the reactor and indication of an extreme challenge to the ability to cool the core exists.

EALs:
1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power > 5%.

   AND

   b. ALL manual trip actions failed to shutdown the reactor as indicated by reactor power > 5%.

   AND

   c. EITHER of the following has occurred:
   - Core Cooling - Red entry conditions met.
   - Heat Sink - Red entry conditions met.

SITE AREA EMERGENCY – SS3
Automatic trip and manual actions taken within the Controls Area (CA) failed to shutdown the reactor.

EALs:
1. a. An automatic reactor trip failed to shutdown the reactor as indicated by reactor power > 5%.

   AND

   b. Manual trip actions taken within the Controls Area (CA) failed to shutdown the reactor as indicated by reactor power > 5%.

ALERT – SA3
Automatic trip failed to shutdown the reactor and the manual actions taken from the Controls Area (CA) are successful in shutting down the reactor.

EALs:
1. a. An automatic reactor trip failed to shutdown the reactor.

   AND

   b. Manual trip actions taken within the Controls Area (CA) successfully shutdown the reactor as indicated by reactor power ≤ 5%.

UNUSUAL EVENT – SU3
Inadvertent criticality.

EALs:
1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.

4 Annunciators

Table S-1: Critical Safety Functions
Reactivity Control (ability to shut down the reactor and keep it shut down)
RCS inventory (ability to cool the core)
Secondary heat removal (ability to maintain a heat sink)

Table S-2: Significant Transients
Automatic turbine runback > 25% thermal power
Electrical load rejection > 25% full electrical load
Reactor trip
Safety injection actuation

SITE AREA EMERGENCY – SS4
Inability to monitor a significant transient in progress.

EALs:
1. a. Loss of > 75% of EITHER of the following for 15 minutes* or longer:
   - Control Room Annunciator Panels (A1, A2, A4-A11).

     OR
   - Control Room critical safety function indications (Table S-1).

   AND

   b. A Table S-2 significant transient is in progress.

   AND

   c. COMPENSATORY INDICATIONS are unavailable.

ALERT – SA4
Loss of safety system annunciation or indication in the Control Room with either: (1) a significant transient in progress, or (2) COMPENSATORY INDICATIONS are unavailable.

EALs:
1. a. Loss of > 75% of EITHER of the following for 15 minutes* or longer:
   - Control Room Annunciator Panels (A1, A2, A4-A11).

     OR
   - Control Room critical safety function indications (Table S-1).

   AND

   b. EITHER of the following:
   - A Table S-2 significant transient is in progress.

     OR
   - COMPENSATORY INDICATIONS are unavailable.

UNUSUAL EVENT – SU4
Loss of safety system annunciation or indication in the Control Room for 15 minutes or longer.

EALs:
1. Loss of > 75% of EITHER of the following for 15 minutes* or longer:
   - Control Room Annunciator Panels (A1, A2, A4-A11).

     OR
   - Control Room critical safety function indications (Table S-1).

5 T.S. Limits

UNUSUAL EVENT – SU5
Inability to reach required operating mode within Technical Specification limits.

EALs:
1. Plant is not brought to required operating mode within Technical Specification LCO action statement time.

6 Communications

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

UNUSUAL EVENT – SU6
Loss of all onsite or offsite communications capabilities.

EALs:
1. Loss of ALL of the following onsite communication methods affecting the ability to perform routine operations:
   - Radios.
   - Plant page.
   - Plant telephone system (hardwired).

   OR
2. Loss of ALL of the following offsite communications methods affecting the ability to perform offsite notifications:
   - NRC Emergency Notification System - ENS (Red Phone).
   - NRC Health Physics Network - HPN.
   - Commercial telephones (hardwired and wireless).

7 RCS Leakage

UNUSUAL EVENT – SU7
RCS leakage.

EALs:
Notes:
- Identified, unidentified and pressure boundary RCS leakage as defined by Technical Specifications.
- Relief valve normal operation should be excluded unless it fails to close and cannot be isolated.
1. Unidentified or pressure boundary leakage > 10 gpm.

   OR
2. Identified leakage > 25 gpm.

9 Fuel Clad Degradation

UNUSUAL EVENT – SU9
Fuel clad degradation.

EALs:
1. Letdown Monitor (2CHS-RQ101B) > 2.98E+03 μCi/cc

   OR
2. RCS activity > 21 μCi/gm dose equivalent I-131.

FISSION PRODUCT BARRIER DEGRADATION (F)

GENERAL EMERGENCY – FG1
1. Loss of any two barriers and loss or potential loss of the third barrier.

SITE AREA EMERGENCY – FS1
1. Loss or potential loss of any two barriers.

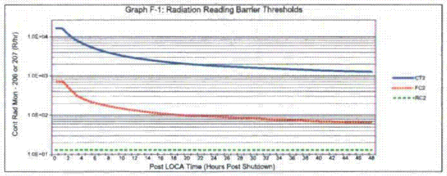
ALERT – FA1
1. Any loss or any potential loss of either fuel clad or RCS.

UNUSUAL EVENT – FU1
1. Any loss or any potential loss of containment.

FPB Identifier: XXX — Barrier Abreviation (FC, RC, or CT); Sub Category (1-10)

* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

Graph F-1: Radiation Reading Barrier Thresholds



Sub-Category	FC - FUEL CLAD Loss	FC - FUEL CLAD Potential Loss	RC - REACTOR COOLANT SYSTEM Loss	RC - REACTOR COOLANT SYSTEM Potential Loss	CT - CONTAINMENT Loss	CT - CONTAINMENT Potential Loss
1. Critical Safety Function Status	1. Core Cooling - Red entry conditions met.	1. Core Cooling - Orange entry conditions met. OR 2. a. Heat Sink - Red entry conditions met. AND b. Heat Sink is required.		1. RCS Integrity - Red entry conditions met. OR 2. a. Heat Sink - Red entry conditions met. AND b. Heat Sink is required.		1. Containment - Red entry conditions met.
2. Containment Rad Monitoring	1. Containment Radiation Monitor (2RMR-RQ206 or 207) > FC2 Line on Graph F-1.		1. Containment Radiation Monitor (2RMR-RQ206 or 207) > 1.1E+01 R/hr (RC2 Line on Graph F-1)			1. Containment Radiation Monitor (2RMR-RQ206 or 207) > CT2 Line on Graph F-1.
3. Core Temperature	1. Three max core exit thermocouples > 1200° F.	1. Three max core exit thermocouples > 729° F.				1. a. Three max core exit thermocouples > 2000°F. AND b. Restoration procedures not effective within 15 minutes. OR 2. a. Three max core exit thermocouples > 1200° F. AND b. RVLIS Full Range < 40% with no RCPs running. AND c. Restoration procedures not effective within 15 minutes.
4. RCS Level		1. RCS level < Table F-1.				
5. RCS Leak Rate			1. RCS leak rate greater than available makeup capacity as indicated by RCS subcooling < 19° normal containment or < 46° adverse containment.	1. UNISOLABLE RCS leak exceeding the capacity of one charging pump (130 gpm) in the normal charging mode.		
6. SG Tube Leakage / Rupture			1. RUPTURED SG results in an SI actuation.		Note: A prolonged release is greater than 4 hours. 1. RUPTURED SG is also FAULTED outside of containment. OR 2. a. Primary-to-Secondary leak rate > 10 gpm. AND b. UNISOLABLE prolonged steam release from affected SG to the environment.	
7. RCS Activity	1. Coolant activity > 300 μCi/gm dose equivalent I-131.					
8. Containment Pressure					1. A containment pressure rise followed by a rapid UNPLANNED drop in containment pressure. OR 2. Containment pressure or sump level response not consistent with LOCA conditions.	1. Containment pressure > 45 psig and rising. OR 2. Containment hydrogen > 4%. OR 3. a. Containment pressure > 11 psig. AND b. Less than one full train of depressurization equipment operating.
9. Containment Isolation Failure					Note: Direct pathways include filtered pathway (e.g., SLCRS). 1. a. Failure of ALL valves in any one line to close. AND b. Direct downstream pathway to the environment exists after containment isolation signal.	
10. EMERGENCY DIRECTOR Judgment	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the fuel clad barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the fuel clad barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the RCS barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the RCS barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates loss of the containment barrier.	1. Any condition in the opinion of the EMERGENCY DIRECTOR that indicates potential loss of the containment barrier.

Table F-1: RVLIS Thresholds		
RVLIS	RCPs	Indication
Full Range	0	40%
Dynamic Range	1	25%
	2	33%
	3	60%

Beaver Valley Unit 2 HOT EAL WALL BOARD Revision 00 EAL Technical Basis Manual

FirstEnergy

WALL BOARDS FOR "INFORMATION ONLY"

EAL Identifier: XXX.X — Category (R,H,E,S,F,C); Emergency classification (G,S,A,U); Subcategory number (1 if no subcategory); Sequential number within subcategory/classification

BEAVER VALLEY UNIT 2

Modes: 1 Power Operation >5% Rx Power; 2 Startup ≤ 5% Rx Power; 3 Hot Standby ≥ 350°F; 4 Hot Shutdown >200°F; 5 Cold Shutdown ≤ 200°F; 6 Refueling; D Defueled

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
1 Security	**HG1** (1 2 3 4 5 6 D) HOSTILE ACTION resulting in loss of physical control of the facility. EALs: 1. A HOSTILE ACTION has occurred such that plant personnel are unable to operate equipment required to maintain safety functions listed below: • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink) OR 2. A HOSTILE ACTION has caused failure of spent fuel cooling systems and IMMINENT fuel damage is likely.	**HS1** (1 2 3 4 5 6 D) HOSTILE ACTION within the PROTECTED AREA. EALs: 1. A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the Security Shift Supervisor.	**HA1** (1 2 3 4 5 6 D) HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat. EALs: 1. A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the Security Shift Supervisor. OR 2. A validated notification from the NRC of a LARGE AIRCRAFT attack threat within 30 minutes of the site.	**HU1** (1 2 3 4 5 6 D) Confirmed SECURITY CONDITION or threat which indicates a potential degradation in the level of safety of the plant. EALs: 1. A SECURITY CONDITION that does not involve a HOSTILE ACTION as reported by the Security Shift Supervisor. OR 2. A credible site specific security threat notification. OR 3. A validated notification from the NRC providing information of a LARGE AIRCRAFT threat.
2 CR Evacuation		**HS2** (1 2 3 4 5 6 D) Control Room evacuation has been initiated and plant control cannot be established. EALs: 1. a. Control Room evacuation has been initiated. AND b. Control of ANY of the following safety functions is not established from an alternate location within 15 minutes. • Reactivity Control (ability to shut down the reactor and keep it shut down) • RCS inventory (ability to cool the core) • Secondary heat removal (ability to maintain a heat sink)	**HA2** (1 2 3 4 5 6 D) Control Room evacuation has been initiated. EALs: 1. Control Room evacuation has been initiated.	
3 Natural or Destructive Phenomena	* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time. Table H-1: • Cable Vault and Rod Control Bldg • Containment Building • Control Building • Demin. Water Storage (2FWE-TK210) • Diesel Generator Building • Fuel Handling Building • Intake Structure Pump Cubicles • Main Steam Valve Room • Primary Aux. Building (accept elev. 773') • RWST (2QSS-TK21) • Safeguards Building • Service Building (except FW Reg Viv Rm)		**HA3** (1 2 3 4 5 6 D) Natural or destructive phenomena affecting VITAL AREAS. EALs: 1. a. Seismic event > 0.06g (OBE) acceleration (as indicated by B lamp on 2ERS-CCC-1 Seismic Instrumentation Central Control Cabinet). AND b. Earthquake confirmed by ANY of the following: • Earthquake felt in plant. • National Earthquake Center. • Control Room indication of degraded performance of systems required for the safe shutdown of the plant. OR 2. Tornado or high winds > 80 mph resulting in EITHER of the following: • VISIBLE DAMAGE to ANY structures in Table H-1 areas containing safety systems or components. • Control Room indication of degraded performance of those safety systems. OR 3. Internal flooding in Table H-1 areas resulting in EITHER of the following: • Electrical shock hazard that precludes access to operate or monitor safety equipment. • Control room indication of degraded performance of those safety systems. OR 4. High river level > 705 feet MSL resulting in EITHER of the following: • VISIBLE DAMAGE to ANY structures in Table H-1 areas containing safety systems or components. • Control Room indication of degraded performance of those safety systems. OR 5. Low river level (LR-1CW-101) < 650 feet MSL resulting in Control Room indication of degraded performance of safety systems located in Table H-1 areas. OR 6. Turbine failure-generated PROJECTILES resulting in EITHER of the following: • VISIBLE DAMAGE to or penetration of ANY structures in Table H-1 areas containing safety systems or components. • Control Room indication of degraded performance of those safety systems. OR 7. Vehicle crash resulting in EITHER of the following: • VISIBLE DAMAGE to ANY structures in Table H-1 areas containing safety systems or components. • Control Room indication of degraded performance of those safety systems.	**HU3** (1 2 3 4 5 6 D) Natural or destructive phenomena affecting the PROTECTED AREA. EALs: 1. a. Seismic event > 0.01g acceleration (as indicated by initiation of the Accelerograph Recording System on Ann A10-5H, Init of Seismic Exceed Preset and/or Spectral Accelerations). AND b. Earthquake confirmed by EITHER of the following: • Earthquake felt in plant. • National Earthquake Center. OR 2. a. Tornado within the PROTECTED AREA. OR b. High winds > 80 mph. OR 3. Internal flooding in Table H-1 areas that has the potential to affect safety related equipment required by Technical Specifications for the current operating mode. OR 4. High river water level > 705 feet MSL. OR 5. Low river water level (LR-1CW-101) < 650 feet MSL. OR 6. Turbine failure resulting in casing penetration or damage to turbine or generator seals.
4 FIRE / EXPLOSION	Table H-1: • Cable Vault and Rod Control Bldg • Containment Building • Control Building • Demin. Water Storage (2FWE-TK210) • Diesel Generator Building • Fuel Handling Building • Intake Structure Pump Cubicles • Main Steam Valve Room • Primary Aux. Building (accept elev. 773') • RWST (2QSS-TK21) • Safeguards Building • Service Building (except FW Reg Viv Rm)		**HA4** (1 2 3 4 5 6 D) FIRE or EXPLOSION affecting the operability of plant safety systems required to establish or maintain safe shutdown. EALs: 1. FIRE or EXPLOSION resulting in EITHER of the following: • VISIBLE DAMAGE to ANY structures in Table H-1 areas containing safety systems or components. • Control Room indication of degraded performance of those safety systems.	**HU4** (1 2 3 4 5 6 D) FIRE within the PROTECTED AREA not extinguished within 15 minutes of detection or EXPLOSION within the PROTECTED AREA. EALs: Note: Immediately adjacent to applies to FIRES that directly impact or obstruct the areas of concern. 1. FIRE not extinguished within 15 minutes* of Control Room notification or verification of a Control Room FIRE alarm in actual contact with or immediately adjacent to ANY of the Table H-1 areas. OR 2. EXPLOSION within the PROTECTED AREA.
5 Toxic Gas			**HA5** (1 2 3 4 5 6 D) Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of operable equipment required to maintain safe operations or safely shutdown the reactor. EALs: Notes: • If the equipment in the stated area was already inoperable, or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event. • This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area. 1. Access to a VITAL AREA is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of systems required to maintain safe operations or safely shutdown the reactor.	**HU5** (1 2 3 4 5 6 D) Release of toxic, corrosive, asphyxiant or flammable gases deemed detrimental to NORMAL PLANT OPERATIONS. EALs: Note: This EAL does not apply to FIRE fighting activities that automatically or manually activate a FIRE suppression system in an area. 1. Toxic, corrosive, asphyxiant or flammable gases in amounts that have or could adversely affect NORMAL PLANT OPERATIONS. OR 2. Report by local, county or state officials for evacuation or sheltering of site personnel based on an offsite event.
6 EMERGENCY DIRECTOR Judgment	**HG6** (1 2 3 4 5 6 D) Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of GENERAL EMERGENCY. EALs: 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA Protective Action Guide exposure levels offsite for more than the immediate site area.	**HS6** (1 2 3 4 5 6 D) Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of SITE AREA EMERGENCY. EALs: 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts: (1) toward site personnel or equipment that could lead to the likely failure of or, (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA Protective Action Guide exposure levels beyond the site boundary.	**HA6** (1 2 3 4 5 6 D) Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an ALERT. EALs: 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA Protective Action Guide exposure levels.	**HU6** (1 2 3 4 5 6 D) Other conditions exist which in the judgment of the EMERGENCY DIRECTOR warrant declaration of an UNUSUAL EVENT. EALs: 1. Other conditions exist which in the judgment of the EMERGENCY DIRECTOR indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs.

HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

SYSTEM MALFUNCTIONS - COLD

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
1 Loss of AC Power	* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.		**CA1** (5 6 D) Loss of all offsite and all onsite AC power to emergency busses for 15 minutes or longer. EALs: 1. Loss of ALL offsite and ALL onsite AC power to BOTH AE and DF 4KV emergency busses for 15 minutes* or longer.	**CU1** (5 6) AC power capability to emergency busses reduced to a single source for 15 minutes or longer. EALs: 1. a. AC power to AE and DF 4KV emergency busses is reduced to a single source for 15 minutes* or longer. AND b. Any additional single power source failure will result in loss of ALL AC power to BOTH AE and DF 4KV emergency busses.
2 Loss of DC Power				**CU2** (5 6) Loss of required DC power for 15 minutes or longer. EALs: 1. < 110.4 VDC on the required DC busses for 15 minutes* or longer.
3 Failure of RPS				**CU3** (5 6) Inadvertent criticality. EALs: 1. UNPLANNED sustained positive startup rate observed on nuclear instrumentation.
6 Communications				**CU6** (5 6 D) Loss of all onsite or offsite communications capabilities. EALs: 1. Loss of ALL of the following onsite communication methods affecting the ability to perform routine operations: • Radios. • Plant page. • Plant telephone system (hardwired). OR 2. Loss of ALL of the following offsite comunications methods affecting the ability to perform offsite notifications: • NRC Emergency Notification System - ENS (Red Phone). • NRC Health Physics Network - HPN. • Commercial telephones (hardwired and wireless).
7 RCS Leakage	**CG7** (5 6) Loss of RCS inventory affecting fuel clad integrity with containment challenged. EALs: 1. a. RCS level < 58% RVLIS Full Range (top of active fuel) for 30 minutes* or longer. AND b. ANY Table C-1 containment challenge indications. OR 2. a. RCS level cannot be monitored with core uncovery for 30 minutes* or longer. AND b. Loss of RCS inventory as indicated by ANY of the following: • Containment Radiation Monitor (2RMR-RQ206 or 207) > 15 R/hr. • Erratic source range monitor indication. • UNPLANNED level rise in Containment sumps or incore instrument sump. AND c. ANY Table C-1 containment challenge indications. Table C-1: Containment Challenge Indications • CONTAINMENT CLOSURE not established. • Hydrogen concentration > 4% inside containment. • UNPLANNED rise in containment pressure.	**CS7** (5 6) Loss of RCS inventory affecting core decay heat removal capability. EALs: 1. a. CONTAINMENT CLOSURE not established. AND b. RCS level < 64% RVLIS Full Range (6" below bottom of hot leg). OR 2. a. CONTAINMENT CLOSURE established. AND b. RCS level < 58% RVLIS Full Range (top of active fuel). OR 3. a. RCS level cannot be monitored for 30 minutes* or longer. AND b. Loss of RCS inventory as indicated by ANY of the following: • Containment Radiation Monitor (2RMR-RQ206 or 207) > 15 R/hr. • Erratic source range monitor indication. • UNPLANNED level rise in Containment sumps or incore instrument sump.	**CA7** (5 6) Loss of RCS inventory. EALs: 1. Loss of RCS inventory as indicated by EITHER of the following: • RVLIS Full Range Level (2RCS-LT1321) < 69% (bottom of hot leg). • Refueling Outage Temporary Level Instrument (2RCS-L1102) ≤ 6 inches. OR 2. a. RCS level cannot be monitored for 15 minutes* or longer. AND b. Loss of RCS inventory as indicated by UNPLANNED level rise in Containment sumps or incore instrument sump.	**CU7** (5) RCS leakage. EALs: Note: Relief valve normal operation should be excluded unless it fails to close and cannot be isolated. 1. RCS leakage results in the inability to maintain or restore RCS level > Target Level Band for 15 minutes* or longer.
8 RCS Leakage				**CU8** (6) UNPLANNED loss of RCS inventory. EALs: 1. UNPLANNED RCS level drop as indicated by EITHER of the following: • Refueling Outage Temporary Level Instruments (2RCS-L1102) < 96 inches (vessel flange) for 15 minutes* or longer when the RCS level band is established above the vessel flange. OR • RCS water level drop below the RCS level band for 15 minutes* or longer when the RCS level band is established below the vessel flange. OR 2. a. RCS level cannot be monitored. AND b. Loss of RCS inventory as indicated by UNPLANNED level rise in Containment sumps or incore instrument sump.
10 Heat Sink	Table C-2: RCS Reheat Duration Thresholds		**CA10** (5 6) Inability to maintain plant in cold shutdown. EALs: Note: Full inventory is pressurizer level ≥ 22% actual with loop stops either isolated or unisolated. 1. RCS temperature > 200° F due to an UNPLANNED loss of decay heat removal capability for the greater than the specified duration on Table C-2. OR 2. a. RCS temperature cannot be monitored. AND b. RCS pressure rise > 10 psi due to an UNPLANNED loss of decay heat removal capability (this EAL does not apply in RCS solid plant conditions).	**CU10** (5 6) UNPLANNED loss of decay heat removal capability. EALs: 1. RCS temperature > 200° F due to an UNPLANNED loss of decay heat removal capability. OR 2. Loss of ALL RCS temperature and RCS level indication for 15 minutes* or longer.

Table C-2: RCS Reheat Duration Thresholds

RCS	Cont Closure	Duration
Intact with Full RCS Inventory	N/A	> 60 min**
Not Intact OR Not Full RCS Inventory	Established	> 20 min**
	Not Established	0 min

** If an RCS heat removal system is in operation within this time frame and RCS temperature is being reduced, this EAL is not applicable.

SYSTEM MALFUNCTIONS - COLD

DRY FUEL STORAGE FACILITY

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
E 1 Dry Fuel Storage Facility	* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.			**E-HU1** (NOT APPLICABLE) Damage to a loaded cask CONFINEMENT BOUNDARY. EALs: 1. Damage to a loaded cask CONFINEMENT BOUNDARY.

DRY FUEL STORAGE FACILITY

RADIOLOGICAL EFFLUENT / ABNORMAL RADIATION LEVELS

	GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
1 Radiological Effluent	**RG1** (1 2 3 4 5 6 D) Offsite dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology. EALs: Note: If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results. 1. The following gaseous effluent monitor greater than the reading shown for 15 minutes* or longer: • SLCRS Vent (2HVS-RQ109E) ....1.95E+07 µCi/sec OR 2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of EITHER of the following: • > 1000 mRem TEDE. • > 5000 mRem CDE Child Thyroid. OR 3. Field survey results at or beyond the site boundary indicate EITHER of the following: • Gamma (closed window) dose rate > 1000 mR/hr for 60 minutes* or longer. • Air sample analysis > 5000 mRem CDE Child Thyroid for one hour of inhalation.	**RS1** (1 2 3 4 5 6 D) Offsite dose resulting from an actual or IMMINENT release of gaseous radioactivity greater than 100 mRem TEDE or 500 mRem CDE Child Thyroid for the actual or projected duration of the release using actual meteorology. EALs: Note: If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values. Do not delay declaration awaiting dose assessment results. 1. ANY of the following gaseous effluent monitors greater than the reading shown for 15 minutes* or longer: • SLCRS Vent (2HVS-RQ109E) ....1.95E+06 µCi/sec • Ventilation Vent (2HVS-RQ101B)....1.87E-01 µCi/cc OR 2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of EITHER of the following: • > 100 mRem TEDE. • > 500 mRem CDE Child Thyroid. OR 3. Field survey results at or beyond the site boundary indicate EITHER of the following: • Gamma (closed window) dose rate > 100 mR/hr for 60 minutes* or longer. • Air sample analysis > 500 mRem CDE Child Thyroid for one hour of inhalation.	**RA1** (1 2 3 4 5 6 D) Any release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM limit for 15 minutes or longer. EALs: Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown. 1. ANY of the following gaseous effluent monitors greater than the reading shown for 15 minutes or longer: • SLCRS Vent (2HVS-RQ109E) ......5.88E+05 µCi/sec • Ventilation Vent (2HVS-RQ101B)...8.02E-02 µCi/cc OR 2. Liquid Waste Effluent Monitor (2SGC-RQ100) > 200 times the High alarm setpoint, not to exceed 4.5E-02 µCi/cc, established by a current radioactivity discharge permit for 15 minutes or longer. OR 3. Confirmed sample analysis for gaseous or liquid releases > 200 times the ODCM limit for 15 minutes or longer.	**RU1** (1 2 3 4 5 6 D) Any release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes or longer. EALs: Note: The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown. 1. ANY of the following gaseous effluent monitors greater than the reading shown for 60 minutes or longer: • SLCRS Vent (2HVS-RQ109E) ......5.88E+03 µCi/sec • Ventilation Vent (2HVS-RQ101B)...8.02E-04 µCi/cc OR 2. Liquid Waste Effluent Monitor (2SGC-RQ100) > 2 times the High alarm setpoint established by a current radioactivity discharge permit for 60 minutes or longer. OR 3. Confirmed sample analysis for gaseous or liquid releases > 2 times the ODCM limit for 60 minutes or longer.
2 Abnormal Radiation Levels	* The EMERGENCY DIRECTOR should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.		**RA2** (1 2 3 4 5 6 D) Damage to irradiated fuel or loss of water level that has resulted or will result in the uncovering of irradiated fuel outside the reactor vessel. EALs: 1. A water level drop in the spent fuel pool, transfer tube or reactor cavity that will result in irradiated fuel becoming uncovered. OR 2. > 1000 mR/hr reading on ANY of the following due to damage to irradiated fuel or loss of water level: • Manipulator Crane (2RMR-RQ203) • Fuel Pit Bridge (2RMF-RQ202)	**RU2** (1 2 3 4 5 6 D) UNPLANNED rise in plant radiation levels. EALs: 1. a. UNPLANNED water level drop in the spent fuel pool, transfer canal or reactor cavity as indicated by level < Tech Spec Minimums (23 feet). AND b. Area radiation monitor rise resulting in a High alarm on ANY of the following: • Manipulator Crane (2RMR-RQ203) • Fuel Pit Bridge (2RMF-RQ202) OR 2. UNPLANNED area radiation monitor or radiation survey > 1000 times NORMAL LEVELS.
3 Abnormal Radiation Levels			**RA3** (1 2 3 4 5 6 D) Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions. EALs: 1. Dose rate > 15 mR/hr in ANY of the following areas requiring continuous occupancy to maintain plant safety functions: • Control Room • Central Alarm Station • Secondary Alarm Station	

RADIOLOGICAL EFFLUENT / ABNORMAL RADIATION LEVELS

DEFINITIONS

The terms defined in this section are those which are used in special context in this document and/or are unique to the Beaver Valley Power Station (BVPS).

AFFECTING SAFE SHUTDOWN – [illegible]

EXPLOSION – [illegible]

STRIKE ACTION – [illegible]

Beaver Valley Unit 2
COLD EAL WALL BOARD
Revision 00
EAL Technical Basis Manual

FirstEnergy

WALL BOARDS FOR "INFORMATION ONLY"

EAL Identifier

XXX.X

Category (R,H,E,S,F,C) — Emergency classification (G,S,A,U) — Sequential number within subcategory/classification — Subcategory number (1 if no subcategory)

Modes: 1 Power Operation >5% Rx Power; 2 Startup ≤ 5% Rx Power; 3 Hot Standby ≥ 350°F; 4 Hot Shutdown >200°F; 5 Cold Shutdown ≤ 200°F; 6 Refueling; D Defueled

Appendix 7
L-11-320

Beaver Valley Power Station Unit Nos. 1 and 2 Supporting Calculations
(Two Hundred Ninety-Five pages follow)

The following is a listing of the calculations contained in this appendix:

1. ERS-SMM-11-002, "Containment Radiation Monitor Readings Following Clad Damage (FC2 Loss, FC7 Loss, RC2 Loss and CT2 Potential Loss)," Revision 0

2. ERS-MPD-93-007, "BVPS - U1 Gaseous Radioactivity Monitor Emergency Action Levels," Revision 6

3. ERS-HHM-87-014, "Unit 1 / Unit 2 ODCM Gaseous Effluent Monitor Setpoints," Revision 4

4. 10080-N-779, "BVPS Unit 1 and Unit 2 Response to a Dam Failure," Revision 1 including Addendums 1 and 2

5. ERS-JTL-99-005, "Unit 1 Letdown Radiation Monitor (RM-CH-101) Alarm Setpoint Calculation and Emergency Action Level (EAL) Value Determination," Revision 3

6. ERS-MPD-93-008, "BVPS – U2 Gaseous Radioactivity Monitor Emergency Action Levels," Revision 7

7. ERS-SFL-88-027, "Process Safety Limits, Alarm Setpoints and EAL Indicator Value for 2CHS-RQ101 A/B," Revision 3

8. ERS-ATL-93-021, "Process Alarm Setpoints For Liquid Effluent Monitors," Revision 3

1. ERS-SMM-11-002, “Containment Radiation Monitor Readings Following Clad Damage (FC2 Loss, FC7 Loss, RC2 Loss and CT2 Potential Loss),” Revision 0

Beaver Valley Power Station

Radiation Protection Technical Position/Evaluation/Calculation

Subject	No.	PAGE 1 OF
Containment Radiation Monitor Readings Following Clad Damage (FC2 Loss, FC7 Loss, RC2 Loss and CT2 Potential Loss)	**ERS-SMM-11-002**	**15**

Reference
HPP______ EPP ______ T/S ______ CR ______ DCP______

Category

☐ Technical Position ☒ Technical Evaluation ☐ Calculation

Unit 1 ☒ Unit 2 ☒

Purpose

This Technical Evaluation determines and documents:
>>> The percent of fuel clad failure release equivalent to an RCS concentration of 300 uCi/g,
>>> Containment high range area monitor response to a release to containment atmosphere of RCS containing activity associated with 20% clad damage, RCS with 300 uCi/g dose equivalent I-131, and RCS at the technical specification maximum instantaneous concentration of 21 uCi/g dose equivalent I-131.
Values are provided for both Beaver Valley Unit 1 and Unit 2.

☒ **ORIGINAL ISSUE**

☐ **REVISION #** _____

Revision description:
N/A - Original Issue

by Scott McCain 08/07/11 date	checker/reviewer John Lebda / Michael Unfried 8/8/11 date	*independent review (calculation only)* *N/A - Not a Calculation* *date*

Checklist		Attachments
☒ Purpose	☒ Results	☒ Data Sheets
☒ Methodology	☒ References	☒ Illustrations
☒ Input Data		☐ Printouts
		☐ Code Listings

☒ Transmittal to BVRC	☐ Supt, Rad Ops	☒ Author: Scott McCain
☒ Original RP ERF FILE	☐ Supv, RP Services	☒ Hal Szklinski BV-SIM
☐ MGR, Radiation Protection	☐ Supv, Rad Waste/Effluents	☒ John Lebda, BV-ERF
		☒ Mike Unfried BV-SEB3

Table of Contents

Attachments

1 PURPOSE/OBJECTIVES

1.1 Documentation of the correlation of 300 μCi/gm DEI-131 (dose equivalent iodine – 131) to a percent fuel clad damage for the Fission Product Barrier (FPB) FC7.1(L) basis.

1.2 Documentation of the derivation of the containment radiation monitor (CRM) FPB threshold values used to represent FC2.1(L), RC2.1(L) and CT2.1(PL).

1.3 The following calculations define the objectives of this document:

1.3.1 FC7.1(L) – % fuel clad damage associated with an RCS activity of 300 μCi/gm dose equivalent I-131.

1.3.2 CT2.1(PL) – CRM readings associated with 20% fuel clad damage for various times after reactor shutdown (1-48 hours).

1.3.3 FC2.1(L) – CRM readings associated with the fuel clad damage equivalent of 300 μCi/gm dose equivalent I-131 for various times after reactor shutdown (1-48 hours).

1.3.4 RC2.1(L) – CRM reading associated with the equivalent of TS RCS activity being released instantaneously into containment.

2 METHODOLOGY

2.1 The Beaver Valley U1 and U2 EAL Technical Basis Manuals contain the bases and references for the site specific EAL threshold values used to implement the NEI 99-01 Rev. 5 guidance methodology. This calculation has been developed to provide additional detailed technical documentation on how the containment radiation monitor values used to indicate a loss of the fuel clad and potential loss of containment fission product barriers were derived.

2.2 The bases for the development of site specific EALs are provided in NEI 99-01 Rev 5. The guidance in the NEI document is generic in nature and is therefore not intended to be entirely used "as is." It is intended to give the logic for developing site specific EAL threshold values (Section 5.3 of NEI 99-01).

2.3 NEI 99-01 Rev. 5 basis information for PWR EAL table 5-F-3 fuel clad barrier threshold #2 provides the following guidance for FPB FC7.1(L):

The site specific value corresponds to 300 μCi/gm I-131 equivalent. Assessment by the EAL Task Force indicates that this amount of coolant activity is well above that expected for iodine spikes and corresponds to less than 5% fuel clad damage. This amount of radioactivity indicates significant clad damage and thus the Fuel Clad Barrier is considered lost.

The value can be expressed either in mR/hr observed on the sample or as μCi/gm results from analysis.

2.4 NEI 99-01 Rev. 5 basis information for PWR EAL table 5-F-3 containment barrier threshold #6 provides the following guidance for FPB CT2.1(PL):

The site specific reading is a value which indicates significant fuel damage well in excess of the thresholds associated with both loss of Fuel Clad and loss of RCS barriers. As stated in Section 3.8 [of NEI 99-01], *a major release of radioactivity requiring off-site protective actions from core damage is not possible unless a major failure of fuel cladding allows radioactive material to be released from the core into the reactor coolant.*

Regardless of whether containment is challenged, this amount of activity in containment, if released, could have such severe consequences that it is prudent to treat this as a potential loss of containment, such that a General Emergency declaration is warranted.

NUREG-1228, "Source Estimations During Incident Response to Severe Nuclear Power Plant Accidents," indicates that such conditions do not exist when the amount of clad damage is less than 20%. Unless there is a site specific analysis justifying a higher value, it is recommended that a radiation monitor reading corresponding to 20% fuel clad damage be specified here.

2.5 NEI 99-01 Rev. 5 basis information for PWR EAL table 5-F-3 fuel clad barrier threshold #6 provides the following guidance for FPB FC2.1(L):

The site specific reading is a value which indicates the release of reactor coolant, with elevated activity indicative of fuel damage, into the containment.

The reading should be calculated assuming the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with a concentration of 300 μCi/gm dose equivalent I-131 into the containment atmosphere.

Reactor coolant concentrations of this magnitude are several times larger than the maximum concentrations (including iodine spiking) allowed within technical specifications and are therefore indicative of fuel damage.

Caution: it is important to recognize that in the event the radiation monitor is sensitive to shine from the reactor vessel or piping, spurious readings will be present and another indicator of fuel clad damage is necessary or compensated for in the threshold value.

2.6 NEI 99-01 Rev. 5 basis information for PWR EAL table 5-F-3 reactor coolant barrier threshold #6 provides the following guidance for FPB RC2.1(L):

The site specific reading is a value which indicates the release of reactor coolant to the containment.

The reading should be calculated assuming the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with normal operating concentrations (i.e., within T/S) into the containment atmosphere.

This reading will be less than that specified for FC2(L)1. Thus, this threshold would be indicative of a RCS leak only. If the radiation monitor reading increased to that specified by Fuel Clad barrier threshold, fuel damage would also be indicated.

However, if the site specific physical location of the containment radiation monitor is such that radiation from a cloud of released RCS gases could not be distinguished from radiation from adjacent piping and components containing elevated reactor coolant activity, this threshold should be omitted and other site specific indications of RCS leakage substituted.

2.7 FC7 Loss: The methodology used to determine the equivalent amount of fuel clad damage associated with an RCS activity of 300 µCi/gm is a simple mathematical relationship between the total DEI-131 activity in the fuel clad and the target DEI-131 activity for the given % clad damage.

2.8 CT2 Potential Loss: The methodology used to develop the containment radiation monitor reading graph for 20% clad damage is by curve fit from table data provided in calculation 10080-UR(B)-507.

2.9 FC2 Loss: The methodology used to develop the containment radiation monitor reading graph for the 300 µCi/gm DEI-131 is by ratio of the 20% clad damage monitor readings to 300 µCi/gm DEI-131 equivalent % clad damage monitor readings. This differs from the monitor response calculated in UR(B)-507, which uses an operational equilibrium mix of 0.35 µCi/g as the basis. The isotopic ratios associated with 20% clad failure is representative of fuel failure event while the operational equilibrium isotopic ratios are not. This provides better alignment with the NEI basis for the FC2 Loss threshold.

2.10 RC2 Loss: The methodology used to develop the containment radiation monitor reading values for the high TS DEI-131 is by ratio of the 0.35 µCi/gm DEI-131 monitor readings to 21 µCi/gm DEI-131 monitor readings. This methodology is acceptable because if RCS activity exceeds the 0.35 µCi/gm DEI-131 value, then Technical Specification Figure 3.4.16-1 requires that it remain below the high setpoint of 21 µCi/gm DEI-131 for full power operation.

3 DESIGN INPUTS

3.1 Mass conversion – 453.6 gm/lbm

3.2 0.05 (5%) halogen core release fraction (RF) for a minor fuel clad damage scenario (NUREG-1465 Table 3.13).

3.3 RCS Inputs (10080-UR(B)-484)

- RCS Volume .... 8.332E+03 ft^3
- Pressurizer Volume .... 7.08E+02 ft^3
- RCS Average Density .... 45.46 lbm/ft^3

3.4 Iodine Source Term Information

3.4.1 Iodine core activity values are taken from 10080-UR(B)-483 Table 1.

3.4.2 DEI isotopic conversion factors are taken from 10080-UR(B)-484 table 12.

	Core Activity (Ci)	DEI-131 ICF
I-131	7.78E+07	1.00E+00
I-132	1.14E+08	5.88E-03
I-133	1.60E+08	1.67E-01
I-134	1.77E+08	1.00E-03
I-135	1.52E+08	2.94E-02

3.5 Containment Radiation Monitor (CRM) Reading for 20% Clad Failure

CRM readings for 20% clad failure are taken from 10080-UR(B)-507.

Time (Hours)	Unit 1 (R/Hr)		Unit 2 (R/Hr)	
	Table 14 219A	Table 15 219B	Table 28 206	Table 29 207
0.00833	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.083	3.08E+03	2.71E+03	3.66E+03	3.82E+03
0.1	3.68E+03	3.24E+03	4.37E+03	4.57E+03
0.50833	1.52E+04	1.34E+04	1.81E+04	1.89E+04
1	1.17E+04	1.03E+04	1.40E+04	1.46E+04
1.80833	8.55E+03	7.54E+03	1.02E+04	1.06E+04
2	8.05E+03	7.09E+03	9.57E+03	1.00E+04
8	3.32E+03	2.93E+03	3.95E+03	4.13E+03
24	1.55E+03	1.37E+03	1.85E+03	1.93E+03
96	7.21E+02	6.36E+02	8.58E+02	8.98E+02

3.6 Containment Radiation Monitor (CRM) Reading for RCS at 0.35 µCi/gm DEI-131

CRM readings for RCS at 0.35 µCi/gm DEI-131are taken from 10080-UR(B)-507.

Time (Hours)	Unit 1 (R/Hr)		Unit 2 (R/Hr)	
	Table 18 219A	Table 19 219B	Table 32 206	Table 33 207
0.00833	6.06E-01	5.34E-01	7.22E-01	7.55E-01
0.083	6.02E-01	5.30E-01	7.17E-01	7.50E-01
0.1	6.01E-01	5.29E-01	7.16E-01	7.49E-01
0.50833	5.79E-01	5.10E-01	6.90E-01	7.21E-01
1	5.49E-01	4.83E-01	6.54E-01	6.84E-01
1.80833	5.05E-01	4.45E-01	6.02E-01	6.29E-01
2	4.96E-01	4.37E-01	5.91E-01	6.18E-01
8	3.52E-01	3.10E-01	4.20E-01	4.39E-01
24	2.52E-01	2.22E-01	3.01E-01	3.15E-01
96	1.50E-01	1.32E-01	1.79E-01	1.87E-01

Note: Calculated values are below the low range (1 R/hr) of the containment high range monitors.

4 ASSUMPTIONS

4.1 The NUREG-1465 Table 3.13 gap release fraction of 0.05 (5%) for halogens was selected over the 3% value in the note to table 3.13 which assumes long-term core cooling is maintained. This assumption results in a slightly lower calculated clad failure value and is conservative with regard to the containment monitor reading used for the fission product barrier threshold.

4.2 A pressurizer liquid volume of 708 ft^3 from 10080-UR(B)-484 was included in the total coolant volume used to determine the % clad failure equivalent to 300 µCi/gm DEI-131. At 60% pressurizer level for normal operation volume is calculated to be approximately 842 ft^3. At 1404 kW pressurizer heater capacity, all heater banks are capable of supporting a normal operations spray flow rate of around 85 gpm, thereby replacing the liquid volume once each 75 minutes. Unit 2 currently has 974 kW heater output (plus 430 kW proportional heater in auto), which results in a recirculation time of ~100 to 120 minutes. Unit 1 would be longer at around 200 minutes. Both of these time periods fall within the period used to develop the fission product barrier containment radiation monitor reading graphs.

4.3 The 20% clad failure CRM values developed in this document are based on the lower monitor reading of each unit for ease of use. Inherent assumption limitations and operational variability of the input parameters (i.e. maximum source term) make the use of the lower monitor value reasonable and slightly conservative.

- U1 219B readings are 88% of the U1 219A readings.
- U2 206 readings are 96% of the U2 207 readings.

4.4 The CRM values for the 0 to 1 hour period are set at the 1 hour value for ease of use. Calculated values show fluctuation up and down over several decades of range hindering the prompt determination of barrier status. Establishing a single value for the 0 to 1 hour period is reasonable and conservative.

4.5 TS basis B 3.4.16 analyses are for two cases of RCS activity. The RC2 threshold values are based on the higher RCS TS activity of 21 µCi/gm DEI-131 to provide an on scale CRM reading.

5 CALCULATIONS

5.1 Fuel Clad Damage Estimate Based on 300 µCi/gm DEI-131

See Attachment 1 for the iterative results to the below calculation steps used to determine the fuel clad source term activity and the % clad damage.

5.1.1 Reactor Coolant System (RCS) Mass (mRCS)

$$\mathbf{mRCS\ (gm) = RCS\ (ft^3) \times Density\ lbm/ft^3 \times 453.6\ gm/lbm}$$

5.1.2 100% Core Activity Equivalent Halogen Coolant Concentrations

10080-UR(B)-483 Table 1 provides a total core activity, in Curies, for each iodine isotope. Those values are converted to an equivalent coolant concentration representing 100% core activity, in µCi/gm, as follows:

$$\mathbf{Coolant\ Activity_{core\text{-}i}\ (\mu Ci/gm) = \frac{Core\ Activity_i\ (Ci) \times 1E{+}06\ (\mu Ci/Ci)}{mRCS\ (gm)}}$$

5.1.3 100% Fuel Clad Activity Equivalent Halogen Coolant Concentrations

The 100% core coolant activity is reduced by the release fraction (RF) to represent 100% fuel clad coolant activity by multiplying as follows:

$$\mathbf{Coolant\ Activity_{clad\text{-}i}\ (\mu Ci/gm) = Coolant\ Activity_{core\text{-}i}\ (\mu Ci/gm) \times RF}$$

5.1.4 100% Fuel Clad Activity Equivalent Coolant DEI-131 Concentrations

The total DEI coolant activity associated with 100% fuel clad is calculated from the DEI isotopic conversion factors (ICFs) as follows:

$$\mathbf{Total_{DEI}\ (\mu Ci/gm) = \sum Coolant\ Activity_{clad\text{-}i}\ (\mu Ci/gm) \times DEI\ ICF_i}$$

5.1.5 % Clad Damage for 300 µCi/gm DEI-131

$$\mathbf{\%\ Clad\ Damage = Target_{DEI}\ (\mu Ci/g)\ /\ Total_{DEI}\ (\mu Ci/g)}$$

5.2 Containment Radiation Monitor (CRM) Readings for 20% Clad Damage

See Attachment 2 for the results of curve fit used to determine the CRM readings for 20% clad damage from 1 to 48 hours post event. See Attachment 3 for the CRM graphs.

5.2.1 The Weibull Model (curve fit) was applied to the 10080-UR(B)-507 CRM data points (0.50833 hours to 96 hours – highest monitor reading to lowest) to develop the coefficients for the below equation.

$$y = a - be^{-cx^d}$$

Where:

y: CRM reading in R/hr

x: post LOCA time in hours

	U1 219B	U2 206
a	16411.588	21812.369
b	16165.003	21434.901
c	0.97050635	1.0028122
d	-0.81144184	-0.82788232

Note: The number of iterations used in the Weibull Model to develop the coefficients for were established such that the fit converged to a tolerance of 1E-6. No weighting was used.

5.3 Containment Radiation Monitor (CRM) Readings for 1% Clad Damage

See Attachment 2 for the ratio results to the below calculation steps used to determine the CRM readings for 1% clad damage from 1 to 48 hours post event. See Attachment 3 for the CRM graphs.

5.3.1 The FC2 Loss CRM readings were developed by ratio of the CT2 Potential Loss CRM readings as follows:

$$\mathbf{CRM_{1\%}\ (R/Hr) = CRM_{20\%}\ (R/Hr) \times \frac{1\%}{20\%}}$$

5.4 Containment Radiation Monitor (CRM) Readings for TS Activity

5.4.1 The RC2 Loss CRM readings were developed by ratio of the lower 0.35 and 21 μCi/gm DEI-131 CRM readings as follows:

$$\mathbf{CRM_{21\ \mu Ci/gm\ DEI\text{-}131}\ (R/Hr) = CRM_{0.35\ \mu Ci/gm\ DEI\text{-}131}\ (R/Hr) \times \frac{21}{0.35}}$$

$$\mathbf{Unit\ 1{:}\ 7.9\ R/Hr = 0.132\ R/Hr \times \frac{21}{0.35}}$$

$$\mathbf{Unit\ 2{:}\ 11\ R/Hr = 0.179\ R/Hr \times \frac{21}{0.35}}$$

6 CONCLUSIONS

6.1 300 µCi/gm DEI-131 is equivalent to 1% fuel clad (gap) damage.

6.2 See Attachment 3 for the CRM graphs representative of 20% fuel clad damage.

6.3 See Attachment 3 for the CRM graphs representative of 1% fuel clad damage.

6.4 Unit 1 RC2 Loss for TS RCS activity of 21 µCi/gm DEI-131 is 7.9 R/Hr.

Unit 2 RC2 Loss for TS RCS activity of 21 µCi/gm DEI-131 is 11 R/Hr.

7 REFERENCES

7.1 NEI 99-01 R5, Methodology for Development of Emergency Action Levels

7.2 NUREG-1465, Accident Source Terms for Light-Water Nuclear Power Plants, February 1995

7.3 10080-UR(B)-483 Table 1, BVPS Uprate Core Inventory – Noble Gases, Halogens, and Other Isotopes with Half-Life Greater than 1 Minute and Activity Greater than 0.01% of the Total Activity (2918 MWth)

7.4 10080-UR(B)-484 Rev 0 and Addendum 1, Primary and Secondary Coolant Design/Technical Specification Activity Concentrations including Pre-Accident Iodine Spike Concentrations and Equilibrium Iodine Appearance Rates.

7.5 10080-UR(B)-507 Rev 0, Containment High Range Area Radiation Monitor Readings due to LOCAs with Various Source Terms – Addresses Alternative Source Term and Power Uprate

7.6 TS Basis B 3.4.16, RCS Specific Activity

	10080-UR(B)-483 Table 1 Core Activity (Curies)	Coolant Activity (uCi/gm 100% Core)	Coolant Activity (uCi/gm 100% Gap)	10080-UR(B)-484 Table 12 DEI ICF	Coolant Activity (uCi/gm 100% Gap DEI)
I-131	7.78E+07	4.17E+05	2.09E+04	1.00E+00	2.09E+04
I-132	1.14E+08	6.12E+05	3.06E+04	5.88E-03	1.80E+02
I-133	1.60E+08	8.58E+05	4.29E+04	1.67E-01	7.17E+03
I-134	1.77E+08	9.50E+05	4.75E+04	1.00E-03	4.75E+01
I-135	1.52E+08	8.15E+05	4.08E+04	2.94E-02	1.20E+03
Total	6.81E+08	3.65E+06	1.83E+05		2.95E+04

RCS Volume (ft3):	8.33E+03
Pressurizer Volume (ft3):	7.08E+02
Total Coolant Volume (ft3):	9.04E+03
Average Coolant Density (lbm/ft3):	4.55E+01
Mass Conversion Factor (g/lbm):	4.54E+02
Total Coolant Mass (gm):	1.86E+08
Activity Conversion Factor (uCi/Ci):	1.00E+06
Release Fraction (RF):	5.00E-02
Target DEI:	3.00E+02
% Clad Damage:	1.0%

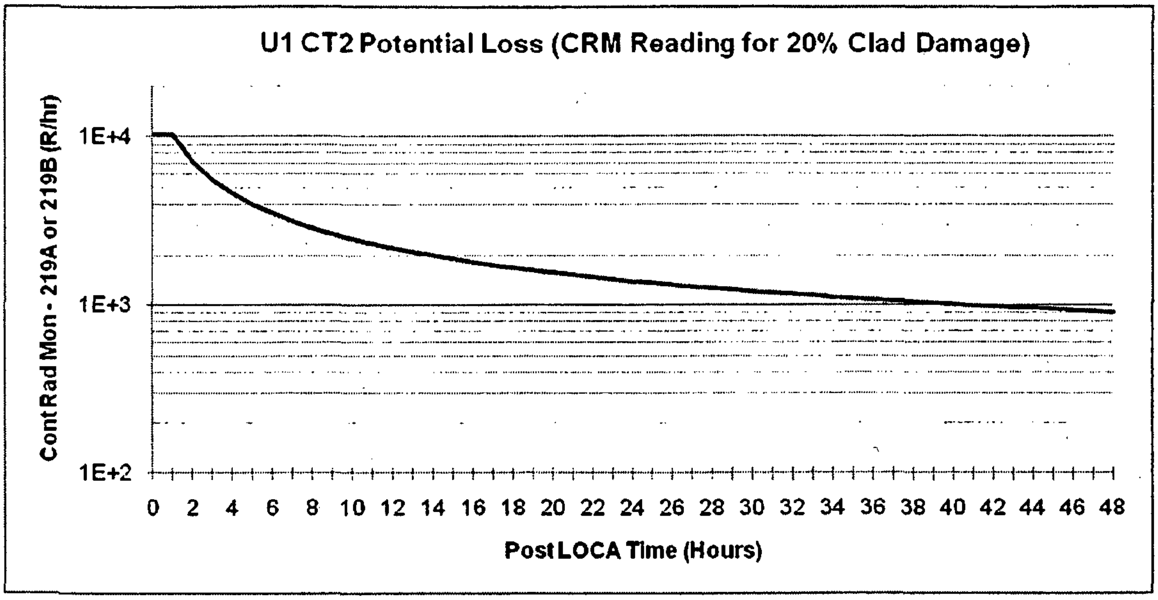
20% Clad Damage Coefficients

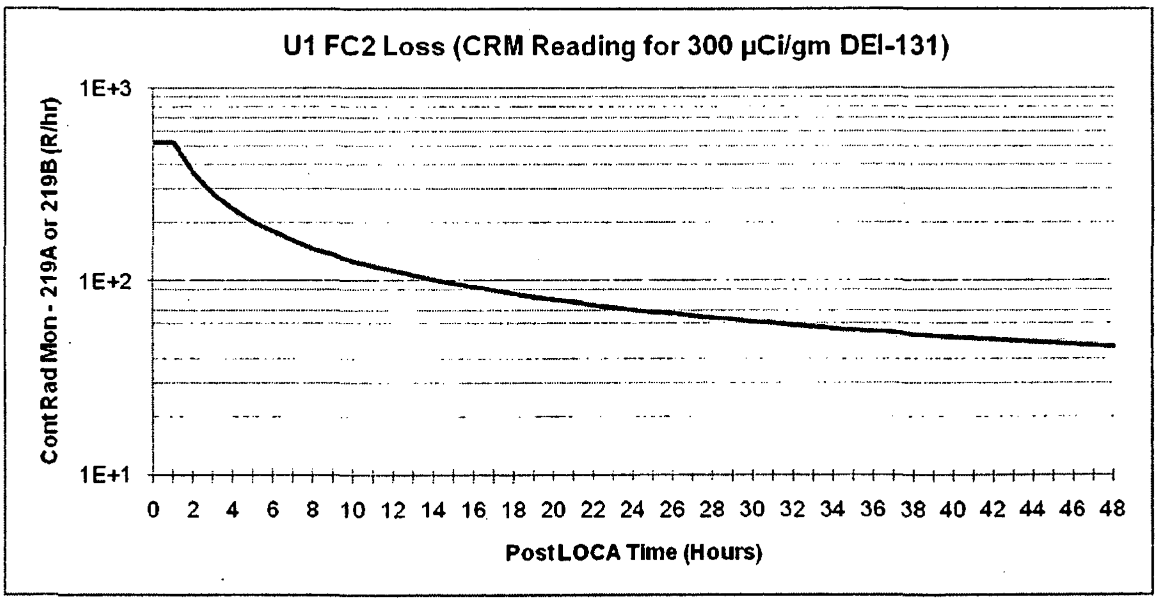
	U1 219B	U2 206
a	16411.588	21812.369
b	16165.003	21434.901
c	0.97050635	1.0028122
d	-0.81144184	-0.82788232

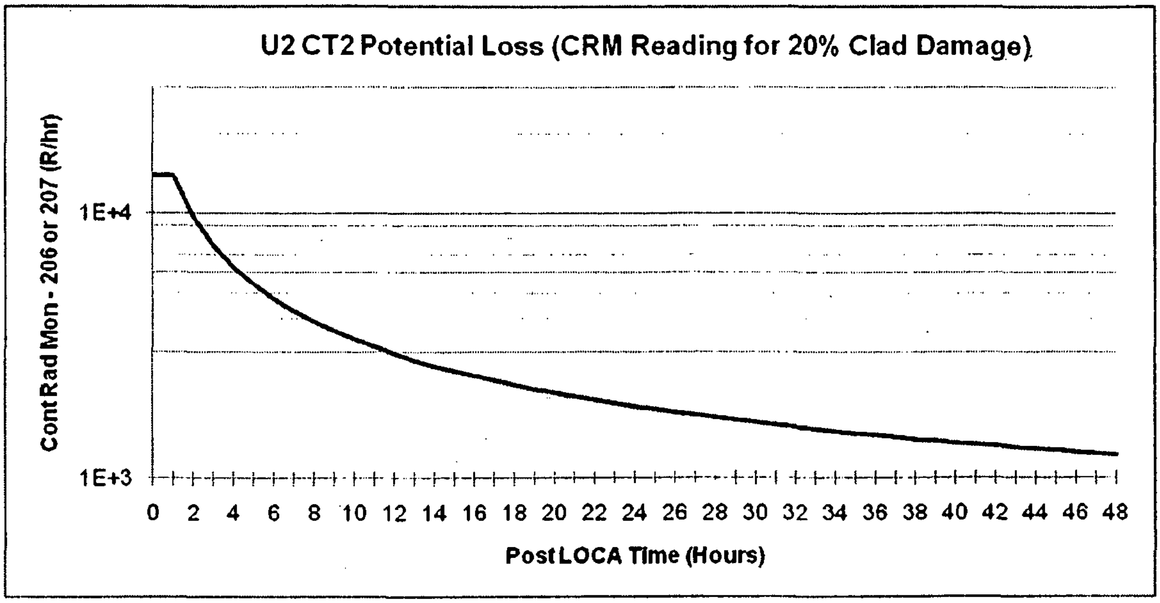
Base Damage (%)	20.0%
Target Damage (%)	1.0%

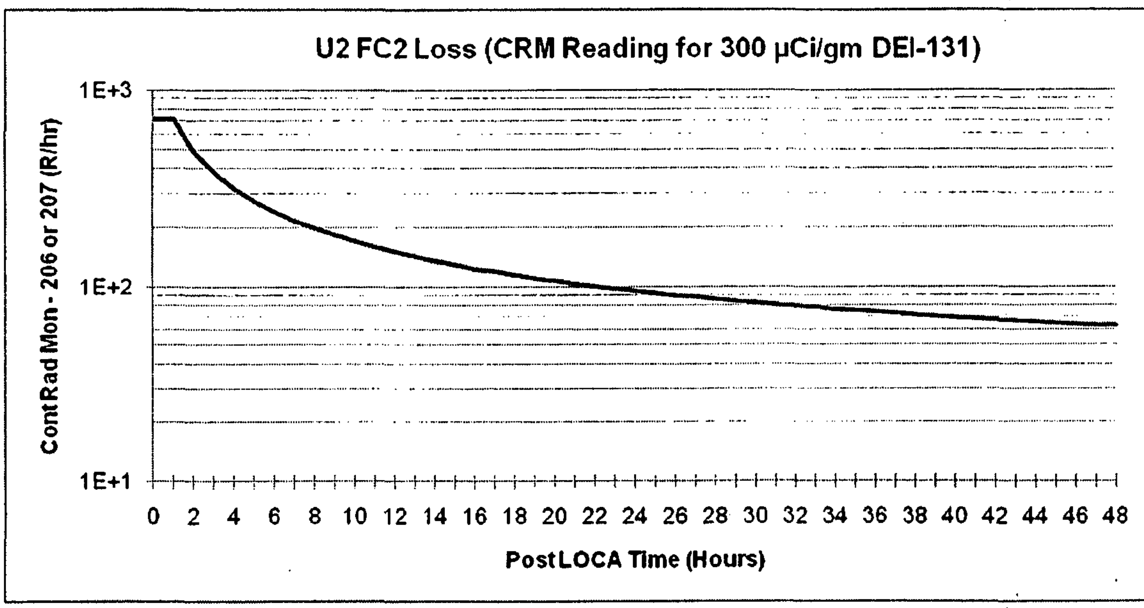
CRM Readings (R/Hr)

	20% Clad Damage		1% Clad Damage	
Hrs	U1 219B	U2 206	U1 219B	U2 206
0	1.0E+04	1.4E+04	5.2E+02	7.1E+02
1	1.0E+04	1.4E+04	5.2E+02	7.1E+02
2	7.1E+03	9.6E+03	3.6E+02	4.9E+02
3	5.6E+03	7.5E+03	2.8E+02	3.8E+02
4	4.6E+03	6.2E+03	2.4E+02	3.2E+02
5	4.0E+03	5.4E+03	2.0E+02	2.7E+02
6	3.5E+03	4.7E+03	1.8E+02	2.4E+02
7	3.2E+03	4.3E+03	1.6E+02	2.2E+02
8	2.9E+03	3.9E+03	1.5E+02	2.0E+02
9	2.7E+03	3.6E+03	1.4E+02	1.8E+02
10	2.5E+03	3.3E+03	1.3E+02	1.7E+02
11	2.3E+03	3.1E+03	1.2E+02	1.6E+02
12	2.2E+03	3.0E+03	1.1E+02	1.5E+02
13	2.1E+03	2.8E+03	1.1E+02	1.4E+02
14	2.0E+03	2.7E+03	1.0E+02	1.4E+02
15	1.9E+03	2.5E+03	9.7E+01	1.3E+02
16	1.8E+03	2.4E+03	9.3E+01	1.2E+02
17	1.7E+03	2.3E+03	8.9E+01	1.2E+02
18	1.7E+03	2.3E+03	8.6E+01	1.1E+02
19	1.6E+03	2.2E+03	8.3E+01	1.1E+02
20	1.6E+03	2.1E+03	8.0E+01	1.1E+02
21	1.5E+03	2.0E+03	7.7E+01	1.0E+02
22	1.5E+03	2.0E+03	7.5E+01	1.0E+02
23	1.4E+03	1.9E+03	7.3E+01	9.8E+01
24	1.4E+03	1.9E+03	7.1E+01	9.5E+01
25	1.4E+03	1.8E+03	6.9E+01	9.3E+01
26	1.3E+03	1.8E+03	6.7E+01	9.1E+01
27	1.3E+03	1.7E+03	6.6E+01	8.8E+01
28	1.3E+03	1.7E+03	6.4E+01	8.6E+01
29	1.2E+03	1.7E+03	6.3E+01	8.5E+01
30	1.2E+03	1.6E+03	6.2E+01	8.3E+01
31	1.2E+03	1.6E+03	6.0E+01	8.1E+01
32	1.2E+03	1.6E+03	5.9E+01	8.0E+01
33	1.1E+03	1.5E+03	5.8E+01	7.8E+01
34	1.1E+03	1.5E+03	5.7E+01	7.7E+01
35	1.1E+03	1.5E+03	5.6E+01	7.5E+01
36	1.1E+03	1.5E+03	5.5E+01	7.4E+01
37	1.1E+03	1.4E+03	5.4E+01	7.3E+01
38	1.0E+03	1.4E+03	5.3E+01	7.2E+01
39	1.0E+03	1.4E+03	5.2E+01	7.1E+01
40	1.0E+03	1.4E+03	5.2E+01	7.0E+01
41	1.0E+03	1.3E+03	5.1E+01	6.9E+01
42	9.8E+02	1.3E+03	5.0E+01	6.8E+01
43	9.7E+02	1.3E+03	4.9E+01	6.7E+01
44	9.6E+02	1.3E+03	4.9E+01	6.6E+01
45	9.5E+02	1.3E+03	4.8E+01	6.5E+01
46	9.3E+02	1.3E+03	4.8E+01	6.4E+01
47	9.2E+02	1.2E+03	4.7E+01	6.3E+01
48	9.1E+02	1.2E+03	4.6E+01	6.3E+01


U1 CT2 Potential Loss (CRM Reading for 20% Clad Damage)
Cont Rad Mon - 219A or 219B (R/hr)
1E+4
1E+3
1E+2
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
Post LOCA Time (Hours)


U1 FC2 Loss (CRM Reading for 300 µCi/gm DEI-131)
Cont Rad Mon - 219A or 219B (R/hr)
1E+3
1E+2
1E+1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
Post LOCA Time (Hours)


U2 CT2 Potential Loss (CRM Reading for 20% Clad Damage)
Cont Rad Mon - 206 or 207 (R/hr)
1E+4
1E+3
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
Post LOCA Time (Hours)


U2 FC2 Loss (CRM Reading for 300 µCi/gm DEI-131)
Cont Rad Mon - 206 or 207 (R/hr)
1E+3
1E+2
1E+1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
Post LOCA Time (Hours)

2. ERS-MPD-93-007, "BVPS - U1 Gaseous Radioactivity Monitor Emergency Action Levels," Revision 6

FORM 1/2-ADM-1611.F28, Rev. 2 RTL# A9.621A

Beaver Valley Power Station

Radiation Protection Technical Position/Evaluation/Calculation

Subject	No.	PAGE 1 OF
BVPS – U1 Gaseous Radioactivity Monitor Emergency Action Levels	**ERS-MPD-93-007**	63

Reference

HPP ____ EPP X T/S ____ CR ____ DCP ____

Category

☐ Technical Position ☒ Technical Evaluation ☐ Calculation

Unit 1 ☒ Unit 2 ☐

Purpose

To apply guidance contained in the NUMARC EAL document to the appropriate gaseous radiation monitors at BVPS Unit 1.

Note: This Technical Evaluation is not an implementing document. Any application of the information contained herein must be reviewed and approved using the established review/approval process for that application.

☐ **ORIGINAL ISSUE**

☒ **REVISION # 6**

Revision description:

Used updated DCFs from ERS-MPD-91-046 Rev. 2. Edited & reformatted all text to incorporate all updates through this revision. Deleted historical information and attachments. Used three significant digits for data input and output consistent with data sources. Removed Fuel Building exhaust monitor as there is not EAL value used for this process monitor. Updated Process Vent monitors ODCM limit & associated Unusual Event and Alert EAL.

by	checker/reviewer	independent review (calculation only)
John T. Lebda 07/22/11 date	Michael G. Unfried 07/22/11 date	N/A date

Checklist

☒ Purpose
☒ Methodology
☒ Input Data
☒ Results
☒ References

Attachments

☒ Data Sheets
☐ Illustrations
☐ Printouts
☐ Code Listings

☒ Transmittal to BVRC
☒ Original RP ERF FILE
☐ MGR, Radiation Protection
☐ Supt, Rad Ops
☐ Supv, RP Services
☐ Supv, Rad Waste/Effluents
☒ Author: John T. Lebda BV-ERF
☒ Hal Szklinski BV-SIM
☒ Michael G. Unfried BV-SEB-3
☐ ____

DISCUSSION

NOTE: This technical document provides radiation monitor indications that correspond to doses associated with emergency classifications. The calculated indications may or may not be associated with Emergency Plan Emergency Action Levels (EALs). Any reference to the EALs herein means that the monitor indication corresponds to the dose level criterion for the EAL. With the proposed implementation of the NEI 99-01 EALs, some monitors previously used to provide EAL indicators may no longer be directly used for this purpose. However, this technical evaluation, beginning with Revision 6, will continue to include all radiation monitors that were included in recent previous revisions, as the evaluation will continue to be the basis for alarm set points. Any use of the monitor indications calculated herein will be subject to the selection, review and approval processes associated with the program/application for which they are used.

This technical evaluation uses accident source terms, radiation monitor nuclide detection efficiencies and nuclide dose conversion factors (TEDE and child thyroid) to calculate radiation monitor readings that correspond to offsite doses of 50, 100 and 1000 mrem TEDE and 250, 500 and 5000 mrem child thyroid. These are used as indicators of the Site Area Emergency (SAE) and General Emergency (GE) classifications. The values shown in the results section are based on the most limiting of all accident type source term and the ODCM[1] annual average atmospheric dispersion factor (X/Q). These monitor indicator values are used in Emergency Plan Emergency Action Levels (EALs). Additionally, indicators for the Unusual Event and Alert classifications are derived. These are simply multiples of the ODCM limit, i.e., 2xODCM limit for the Unusual Event (UE) and 200xODCM limit for the Alert. The calculated radiation monitor readings may be used for Emergency Action Level (EAL) determination following an accident with consequent release of radioactivity, and when the results of more rigorous assessments are not available.

This Technical Evaluation is limited to the Unit 1 gaseous radiation monitors. EAL values for the main steam release pathway and radiation monitors are calculated in ERS-SFL-86-005[3].

Revision History:
This revision, Revision 6, was done to update the TEDE dose conversion factors for iodine by including the dose contribution from 4-day ground contamination. The 4-day ground contamination dose is included when performing dose projections and including it here is consistent with that application. In addition, evaluations from previous revisions (addenda) are removed and any prior changes are incorporated in the main body of this technical evaluation. Also, the original main body was edited and retyped in Microsoft WORD. Removed Fuel Building exhaust monitor as there is not EAL value used for this process monitor. Updated Process Vent monitors ODCM limit & associated Unusual Event and Alert EAL.

Revision 5 used an updated source terms for the Unit 1 SGTR, GAP LOCA, DBA LOCA and RCS LOCA derived in ERS-MPD-01-002 Revision 4. These changed due to changes in the UFSAR design basis radiological analysis prompted by changes in the recirculation spray system and the Unit 1 steam generator atmospheric dump valve capacity. See the associated SWEC calculation packages for the LOCA and SGTR for change details.

Revision 4 replaced Addendum 1 in it's entirety. The remainder of this package was left intact, and this describes the methodology used for the new Addendum 1. This Addendum only updated the Emergency Action Level (EAL) values that are based on the UFSAR design basis accident radiological analyses, i.e., those for the Site Area Emergency and General Emergency classifications.

As such, the listed Unusual Event and Alert EAL values (based on ODCM source terms which remain unchanged) provided in the main body of the package remained valid.

Revision 3 used revised source terms associated with the extended power up-rate and the atmospheric containment conversion.

Revision 2 used revised source terms associated with the extended power up-rate and the atmospheric containment conversion. This revision was not implemented.

Revision 1 used revised source terms.

METHODOLOGY

The bases for the EAL values for the four emergency classifications are:

UE ODCM limit multiplied by two (x2) for greater than 60 minutes

Alert ODCM limit multiplied by two-hundred (x200) for effluent monitors for greater than 15 minutes

SAE Effluent pathway radiation monitor indication that corresponds to 100 mrem TEDE or 500 mrem child thyroid at the site boundary. The lower of the two values is used

GE Effluent pathway radiation monitor indication that corresponds to 1000 mrem TEDE or 5000 mrem child thyroid at the site boundary. The lower of the two values is used

For the SAE and GE evaluations a release duration is necessary to calculate an integrated dose. Consistent with previous revisions and the NUMARC EAL document[4], a release duration of one hour is used. Also, the ODCM annual average atmospheric dispersion factors (X/Q) are used. All of the UFSAR accidents that have a radiological consequence analysis, and several variants of the Loss of Coolant Accident (LOCA) are considered, each having a unique source term. The radiation monitor EAL for each radiation monitor is the lowest monitor indication calculated among all accident types. When input data more specific to accident and actual meteorological conditions are used, the results are expected to differ to some degree. Efforts to obtain effluent or environmental samples followed-up with isotopic analysis should be made to produce a more accurate assessment of offsite dose following any release of radioactivity that may warrant a protective action recommendation.

The original evaluation methodology (used in XRADMON) is:

The fraction of each isotope in the accident source term is calculated

$$\mathbf{S_i = A_i / \Sigma_i A_i} \qquad [1]$$

Since the activity for each isotope is converted to a unitless fraction, the input activity can be expressed in any normal activity units. Note that the input activity is used strictly to determine the activity ratios – the absolute value or units of the input activity has no meaning in subsequent evaluations.

The dose rate, DR_t (mrem/h), at a point downwind from a radiological release is equal to:

$$DR_t = Q_t * (X/Q) * (DCF_t) * (1.1408E\text{-}4\ yr/h) \quad [2]$$

where: Q_t = release rate (uCi/s)
X/Q = dispersion (s/m^3)
DCF_t = dose conversion factor ($mrem\text{-}m^3/uCi\text{-}yr$)

$$1.1408E-4 \quad \textbf{is a unit conversion factor} := \left(\frac{1\,year}{365.25\,day} * \frac{1\,day}{24\,hr}\right)$$

Re-arranging equation [2] to solve for the release rate yields:

$$Q_t = DR_t \ / \ ((X/Q) * (DCF_t) * (1.1408E\text{-}4) \quad [3]$$

The dose rate conversion factor for a mixture of nuclides in the sum of the normalized DCF_i for each nuclide, i:

$$DCF_t = \Sigma_i S_i * DCF_i \quad [4]$$

Substituting equation [4] into equation [3] gives:

$$Q_t = DR_t \ / \ ((1.1408E\text{-}4) * (X/Q) * \Sigma_i S_i * DCF_i) \quad [5]$$

Equation [5] is valid for either TEDE or child thyroid dose, provided the appropriate DCFs are used. In order for the thyroid dose-related monitor reading to be valid, all nuclides must be included in determining S_i. While only radioiodines contribute significantly to thyroid dose, the noble gas nuclides nevertheless contribute to the monitor reading.

Once the release necessary to obtain the desired total dose rate is determined, it can be ratioed by S_i to obtain Q_i, the activity of nuclide i as follows:

$$Q_i = Q_t * S_i$$

To obtain the release concentration, divide by the release flow:

$$C_i = (2.12E\text{-}3 * Q_i) \ / \ flow$$

To obtain the monitor count rate for a single nuclide:

$$CR_i = E_i * C_i$$

Where E_i is the efficiency (cpm/uCi/cc) of the monitor for nuclide i. The count rate for the release as a whole is then:

$$CR_t = \Sigma_i S_i * CR_i$$

The following is a description of the math performed by the EXCEL spreadsheets used in this Technical Evaluation. This has been verified to produce results consistent with the previously used XRADMON application and the math described above.

An EXCEL spreadsheet was made for each accident type and radiation monitor combination that is appropriate for the accident type. Each spreadsheet consists of 15 columns with a row for each radionuclide. At the bottom of each spreadsheet, there is a section used to convert cpm to TEDE and child thyroid. Additionally, each spreadsheet has cells used for inputting release flow rate (cfm) and the atmospheric dispersion factor (X/Q) (s/m^3). Details of all spreadsheet math is provided below:

Column 1 – List of the individual isotopes that comprise the accident source term. Each isotope occupies a row.

Column 2 – Total release quantity (Ci) for each isotope specific to the accident type. These values are taken from ERS-MPD-01-002[5].

Column 3 – Activity ratio for each nuclide. This is a unitless fraction of the total for each nuclide calculated by:

$$\text{fraction} = \overset{\text{col 1}}{\text{Ci}} \;/\; \overset{\Sigma\,\text{col 1}}{\text{Ci}}$$

where A_i is the activity of each individual nuclide.

Column 4 - List of the TEDE dose conversion factors (DCFs) for each radionuclide (mrem-m³/uCi-yr).

Column 5 – Effective DCF

$$\text{mrem-m}^3\text{/uCi-yr} = \overset{\text{col 3}}{\text{mrem-m}^3\text{/uCi-yr}} \;\overset{*}{*}\; \overset{\text{col 4}}{\text{unitless}}$$

Column 6 – Release rate (uCi/s) that, for each nuclide in the specific accident mix, will result in a TEDE rate of 1 mrem per hour of exposure to the total mix. First, math equivalent of equation [5], above is performed in the top section of the spreadsheet and is labeled as (Expression 5). Then, for each nuclide, this is multiplied by the unitless activity fraction in column 3.

$$\text{uCi/s} = \overset{\text{col 3}}{\text{unitless fraction}} * \overset{\text{unit rate}}{(1\ \text{mrem/h}} \;\overset{/}{/}\; \overset{\text{(time conversion * X/Q}}{((1\ \text{yr} / 8760\ \text{hr}) * (\text{s/m}^3)} \overset{*}{*} \overset{\Sigma\,\text{col 5)}}{(\text{mrem-m3 / uCi/yr})))}$$

One mrem per hour is selected so that the calculated release rate need only be multiplied by the desired total mrem to calculate the release rate that will cause the total mrem over one hour. The ODCM X/Q associated with the release point for the radiation monitor is entered in a cell on each spreadsheet.

Column 7 – Release concentration (uCi/cc) that, for each nuclide in the specific accident mix, will result in a TEDE rate of 1 mrem per hour of exposure to the total mix.

$$\text{uCi/cc} = \overset{\text{col 6}}{\text{uCi/s}} \;/\; \overset{\text{flow rate}}{\text{cc/s}}$$

The release pathway flow rate (cfm) for the radiation monitor is entered in a cell on each spreadsheet and converted to cc/s.

Column 8 – List of the monitor specific detection efficiencies (cpm/uCi/cc) for each isotope. These values are taken from ERS-SFL-85-031[5].

Column 9 – The radiation monitor count rate (cpm) that, if sustained for 1 hour, will cause 1 mrem TEDE to an individual located at the site boundary.

col 7 / col 8
cpm = uCi/cc / cpm/uCi/cc

At the bottom of each spreadsheet the calculated cpm for 1 mrem is multiplied by the desired dose (50, 100 and 1000 mrem for TEDE). Again, this applies at the site boundary for a 1 hour exposure duration.

Indicators for child thyroid doses of 250, 500 and 5000 mrem are calculated in the manner described above in columns 10 through 15. The only difference is that TEDE DCFs are replaced with child thyroid DCFs.

INPUT DATA / ASSUMPTIONS

1. Release Source Terms [5]
   Iodine reduction is applied as was done in previous revisions for the release via gaseous pathways. This is already applied in ERS-MPD-01-002 for all accidents except the SGTR, MSLB and LRA/LACP. For these accidents (that are not normally associated with a filtered pathway as modeled in the design basis analyses), an iodine reduction factor of 0.01 is applied herein to ERS-MPD-01-002 source terms for use in this evaluation when the monitor is for a pathway expected to be filtered. This reduction factor is also applied for unfiltered pathways, taking credit for other iodine removal mechanisms (plate-out, scavenging by humidity, agglomeration and retention in leakage fluids), again consistent with previous revisions. Iodine reduction is not applicable for the gaseous waste system failure as this release contains no iodine. Again, iodine reduction as described above is consistent with the intent of the previous revisions and the evaluations performed for Unit 2. This is appropriate as these source terms are intended only for use in EPP applications. As such, they are modified to more closely reflect actual plant conditions.
   The release source terms used are shown in the spreadsheet evaluation printouts included with this evaluation.

2. Unit 1 release point data [2,6,7,8]

Release Point	Radiation monitor	Maximum range (cpm)	Pathway flow rate (cfm)	ODCM X/Q (s/m^3)
Ventilation Vent	RM-VS-101B	1.0E+06	62000	1.03E-04
	RM-VS-109 Ch 5, 7, 9	1.2E+06		
	RM-VS-111 HR. LR	1.2E+06		
Supplementary Collection and Release System (SLCRS)	RM-VS-107B	1.0E+06	49300	9.24E-05
	RM-VS-110 Ch 5, 7, 9	1.2E+06		
	RM-VS-112 HR. LR	1.2E+06		
Process Vent	RM-GW-108B	1.0E+06	1450	2.31E-06
	RM-GW-109 Ch 5, 7, 9	1.2E+06		
	RM-GW-110 HR. LR	1.2E+06		

3. Radiation monitor nuclide detection efficiencies [9]

   Detection efficiencies for each monitor and for each nuclide are taken from ERS-SFL-85-031 and are listed on each spreadsheet.

4. Dose conversion factors [10]
   The TEDE conversion factors (DCFs) are taken from ERS-MPD-91-046[10] (units of mrem-m^3/uCi-yr). In this emergency dose projection application, 4-day dose from ground deposition is included. These DCFs are equivalent to those in EPA Report 400[11] and are expressed with three significant digits.

The child thyroid conversion factors (DCFs) are taken from ERS-MPD-91-046 (units of mrem-m^3/uCi-yr). These were developed from child thyroid DCFs provided in USNRC Regulatory Guide 1.109[12] Table E-9.

All DCFs listed on each spreadsheet.

5. Accident Types [2]

Gap LOCA	Loss of Coolant Accident with release of a fraction of fuel rod gap activity
DBA LOCA	Design Basis Loss of Coolant Accident
RCS LOCA	Loss of Coolant Accident with release of T.S. limit concentration RCS activity
TID LOCA	TID 14844 source term release assumptions (failed ESFs)
SB LOCA	Small break LOCA outside of containment
FHA	Fuel Handling Accident
RCCA	Rod Control Cluster ejection Accident
LACP/LRA	Loss of Non-emergency AC Power/Locked (reactor coolant pump) Rotor Accident
MSLB	Main Steam Line Break
SGTR	Steam Generator Tube Rupture
GWS Fail	Gaseous Waste System Failure

6. Accident Types and Applicable Release Pathways

This technical evaluation provides conversions for all accident source terms for each radiation monitor. Because not all accident types necessarily have a release pathway applicable to each monitor, the following tables are provided to identify the most likely combinations.

Monitors RM-VS-101B; RM-VS-109 Ch. 5, 7, 9; RM-VS-111 HR, LR, Ventilation Vent

DBA LOCA, GAP LOCA, RCS LOCA, TID LOCA, RCCA	Leakage via penetrations and/or in SI piping and equipment
SB LOCA	Piping in PAB
SGTR, LACP/LRA, GWS, MSLB	No reasonable path to this release point
FHA	Fuel handling accident in containment

Monitors RM-VS-107B; RM-VS-110 Ch. 5, 7, 9; RM-VS-112 HR, LR, SLCRS

DBA LOCA, GAP LOCA, RCS LOCA, TID LOCA, RCCA	Leakage from penetrations and/or in SI piping and equipment
FHA	Fuel handling accident in containment/FB
SB LOCA	Piping in safeguards
GWS	Collection from tank vault area
SGTR, MSLB, LACP/LRA	No reasonable path to this release point

Monitors RM-GW-108B; RM-GW-109 Ch. 5, 7, 9; RM-GW-110 HR, LR, Process Vent

DBA LOCA, GAP LOCA, RCS LOCA, TID LOCA, RCCA, SB LOCA, FHA	No reasonable path to this release point
SGTR	Air ejector if containment diversion fails
GWS	Valve failures or tank misalignment
SGTR, LACP/LRA	No likely pathway

7. Application of Monitor Background

Because background indication may vary, it is not considered in this technical evaluation. The EAL values calculated herein are net values, and are in addition to normal monitor background indication.

RESULTS

Attachment 1 details the UE and Alert EAL evaluations. Attachment 2 and Attachment 3 provide a summary and details of the SAE and GE EAL evaluations. No value is shown where the calculated value exceeds the monitor range. The summary of all results is:

Release Point	Radiation monitor	UE	Alert	SAE	GE
Ventilation Vent	RM-VS-101B	**6.00E+3 cpm**	**6.00E+5 cpm**	**(1)**	**(1)**
	RM-VS-109 Ch 5	**2.94E+3 cpm**	**2.94E+5 cpm**	**(1)**	**(1)**
	RM-VS-109 Ch 7	**(2)**	**(2)**	**6.42E+1 cpm**	**6.42E+2 cpm**
	RM-VS-109 Ch 9	**(2)**	**(2)**	**(1)**	**1.08E+1 cpm**
	RM-VS-111 HR	**(2)**	**(2)**	**(1)**	**(1)**
	RM-VS-111 LR	**(2)**	**(2)**	**6.76E+3 cpm**	**6.76E+4 cpm**
Supplementary Collection and Release System (SLCRS)	RM-VS-107B	**1.28E+4 cpm**	**(1)**	**(1)**	**(1)**
	RM-VS-110 Ch 5	**6.76E+3 cpm**	**6.76E+5**	**(1)**	**(1)**
	RM-VS-110 Ch 7	**(2)**	**(2)**	**7.66E+1 cpm**	**7.66E+2 cpm**
	RM-VS-110 Ch 9	**(2)**	**(2)**	**(1)**	**1.86E+1 cpm**
	RM-VS-112 HR	**(2)**	**(2)**	**(1)**	**1.25E+1 cpm**
	RM-VS-112 LR	**(2)**	**(2)**	**1.09E+4 cpm**	**1.09E+5 cpm**
Process Vent	RM-GW-108B	**(1)**	**(1)**	**(1)**	**(1)**
	RM-GW-109 Ch 5	**(1)**	**(1)**	**(3)**	**(3)**
	RM-GW-109 Ch 7	***4.18E+3 cpm**	***4.18E+5 cpm**	**8.08E+5 cpm**	**(1)**
	RM-GW-109 Ch 9	**(2)**	**(2)**	**1.72E+4 cpm**	**1.72E+5 cpm**
	RM-GW-110 HR	**(2)**	**(2)**	**1.49E+4 cpm**	**1.49E+5 cpm**
	RM-GW-110 LR	**(2)**	**(2)**	**(1)**	**(1)**

(1) Monitor range high or low exceeded
(2) No ODCM limit listed for this monitor/channel.
(3) Not calculated. Based on other channels, range will be exceeded.
*No ODCM limit listed for this monitor/channel - listed value was calculated using ODCM methodology.

REFERENCES

1. BVPS Offsite Dose Calculation Manual (ODCM), 1/2-ODC-2.02.
2. BVPS Emergency Plan
3. BVPS Technical Evaluation, ERS-SFL-86-005, "
4. NUMARC EAL Document
5. BVPS Technical Evaluation, ERS-MPD-01-002, "Determination of Release Source Terms for BVPS Accidents for Emergency Planning Purposes".
6. BVPS Procedure 1-HPP-4.
7. BVPS Procedure 1-HPP-4.02-010, "SPING-4 Particulate, Iodine and Noble Gas Monitor (Eberline Instruments)".
8. BVPS Procedure 1-HPP-4.
9. BVPS Technical Evaluation BVPS Technical Evaluation ERS-SFL-85-031, "Gaseous Effluent Monitor Efficiency Data".
10. BVPS Technical Evaluation ERS-MPD-91-046, "Determination of Dose Conversion Factors for Use in EPP Emergency Action Level (EAL) Indicators".
11. USEPA 400-R-92-001, "Manual of Protective Action Guides and Protection Actions for Nuclear Incidents".
12. USNRC Regulatory Guide 1.109, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I".
13. BVPS Emergency Preparedness Plan, EP/I-1A, Tab 7 "Radiological".

UE and Alert EAL Evaluations:

Release Point	Radiation monitor	ODCM Limit[1]	2 x ODCM Limit	200 x ODCM Limit
Ventilation Vent	RM-VS-101B	3.00E+3 cpm	6.00E+3 cpm	6.00E+5 cpm
	RM-VS-109 Ch 5	1.47E+3 cpm	2.94E+3 cpm	2.94E+5 cpm
Supplementary Collection and Release System (SLCRS)	RM-VS-107B	6.44E+3 cpm	1.28E+4 cpm	**1.28E+6 cpm
	RM-VS-110 Ch 5	3.38E+3 cpm	6.76E+3 cpm	6.76E+5 cpm
Process Vent	RM-GW-108B	**3.49E+7 cpm	**6.98E+7 cpm	**6.98E+9 cpm
	RM-GW-109 Ch 5	**2.61E+7 cpm	**5.22E+7 cpm	**5.22E+9 cpm
	[2]RM-GW-109 Ch 7	2.09E+3 cpm	4.18E+3 cpm	4.18E+5 cpm

[1]From 1/2-ODC-2.02 and ERS-HHM-87-014[13]
[2]Calculated using ODCM methodology (ERS-HHM-87-014).
**Exceeds monitor range.

Note that some of the values above exceed the monitor range. These are not useful as an EAL indicator. Because this is the case for the ODCM Process Vent monitor channels, an ODCM type evaluation is performed to determine an ODCM equivalent value for the higher range RM-GW-109 Channel 7. This is based on a continuous release consistent with the other monitor ODCM limit values that are used in this technical evaluation. The evaluation performed is provided on the following page.

RM-GW-109 Channel 7 ODCM Limit Calculation

SPING GW-109 Channel 7				Ai	Si	Vi	Vi * Si	Li	Bi		Qi	Ci	Ei	CR
Isotope	Air Ejector	U1 RBC Vac	U2 RBC Vac		Ai / Sum Ai	1/2-ODC-2.02 Tbl 2.2-12		1/2-ODC-2.02 Tbl 2.2-11		(Li(X/Q)+1.1Bi)	Si * Qt	(2.12E-3*Qi)/F		Ci * Ei
				(Ci/y)		mrem/yr / uCi/s	mrem/yr / uCi/s	mrem/yr / uCi/m^3	mrad/yr / uCi/s	mrem/yr / uCi/s	uCi/s	uCi/cc	cpm / uCi/cc	cpm
Ar-41	0.0E+00	0.0E+00	0.0E+00	0.00E+00	0.00E+00	2.68E-03	0.00E+00	2.69E+02	4.02E-03	0.00E+00	0.00E+00	0.00E+00		0.00E+00
Kr-83m	2.7E-01	5.2E-03	3.7E-04	5.46E-01	5.04E-03	4.58E-08	2.31E-10	0.00E+00	3.96E-05	2.20E-07	5.54E+03	8.10E-03	2.07E+01	1.68E-01
Kr-85m	1.2E+00	5.5E-02	3.9E-03	2.46E+00	2.27E-02	4.70E-04	1.07E-05	1.46E+03	4.06E-04	8.68E-05	2.50E+04	3.65E-02	1.26E+03	4.59E+01
Kr-85	1.6E+00	1.0E+01	7.2E-01	1.39E+01	1.29E-01	5.54E-06	7.13E-07	1.34E+03	8.40E-06	3.99E-04	1.41E+05	2.07E-01	2.19E+01	4.53E+00
Kr-87	8.2E-01	1.1E-02	7.8E-04	1.65E+00	1.53E-02	1.45E-03	2.21E-05	9.73E+03	2.19E-03	3.80E-04	1.68E+04	2.45E-02	6.32E+03	1.55E+02
Kr-88	2.4E+00	7.0E-02	5.0E-03	4.88E+00	4.51E-02	4.09E-03	1.84E-04	2.37E+03	6.16E-03	5.52E-04	4.95E+04	7.24E-02	1.56E+04	1.13E+03
Kr-89	7.7E-02	4.3E-05	3.1E-06	1.54E-01	1.42E-03	1.25E-03	1.78E-06	1.01E+04	1.88E-03	3.62E-05	1.56E+03	2.29E-03	1.46E+04	3.34E+01
Kr-90	0.0E+00	0.0E+00	0.0E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.29E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00
Xe-131m	8.0E-02	1.8E-01	1.3E-02	3.53E-01	3.26E-03	1.67E-04	5.45E-07	4.76E+02	3.09E-04	4.70E-06	3.59E+03	5.24E-03	1.60E+02	8.40E-01
Xe-133m	5.6E-01	3.1E-01	2.2E-02	1.45E+00	1.34E-02	1.32E-04	1.77E-06	9.94E+02	2.61E-04	3.47E-05	1.47E+04	2.16E-02	3.31E+02	7.13E+00
Xe-133	2.3E+01	2.7E+01	1.9E+00	7.49E+01	6.92E-01	1.54E-04	1.07E-04	3.06E+02	2.76E-04	7.00E-04	7.61E+05	1.11E+00	3.01E+02	3.35E+02
Xe-135m	2.0E-01	6.2E-04	4.4E-05	4.01E-01	3.70E-03	6.21E-04	2.30E-06	7.11E+02	9.50E-04	9.95E-06	4.07E+03	5.95E-03	3.43E+03	2.04E+01
Xe-135	2.8E+00	2.7E-01	1.9E-02	5.89E+00	5.44E-02	6.96E-04	3.79E-05	1.86E+03	1.05E-03	2.97E-04	5.98E+04	8.75E-02	1.98E+03	1.73E+02
Xe-137	1.3E-01	8.8E-05	6.3E-06	2.60E-01	2.40E-03	9.66E-05	2.32E-07	1.22E+04	1.46E-04	6.81E-05	2.64E+03	3.86E-03	1.50E+03	5.78E+00
Xe-138	6.6E-01	1.7E-03	1.2E-04	1.32E+00	1.22E-02	2.22E-03	2.71E-05	4.13E+03	3.34E-03	1.61E-04	1.34E+04	1.96E-02	8.97E+03	1.76E+02
TOTAL				1.08E+02	1.00E+00		3.96E-04			2.73E-03		1.61E+00		2.09E+03

ODCM X/Q	2.31E-06
FLOW RATE	1.45E+03
WB Qt (500/Sum (Vi*Si))	1.26E+06
SKIN Qt (3000/Sum (Li(X/Q)+1.1Bi)Si)	1.10E+06

Refer to ERS-HHM-87-014 for methodology details
Ei (detection efficiency) from ERS-SFL-85-031

Evaluation Summary – Release Point 1, Ventilation Vent:

SPING VS-109 Channel 5	SAE Criteria		GE Criteria		
	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
	5.55E+06	1.22E+06	5.55E+07	1.22E+07	GAP LOCA
	6.34E+06	1.80E+06	6.34E+07	1.80E+07	DBA LOCA
	4.23E+07	1.17E+07	4.23E+08	1.17E+08	RCS LOCA
	1.57E+06	1.56E+06	1.57E+07	1.56E+07	TID LOCA
	4.60E+06	2.31E+06	4.60E+07	2.31E+07	SB LOCA
	9.45E+06	2.61E+07	9.45E+07	2.61E+08	RCCA
Minimum values =	**1.22E+06**		**1.22E+07**		

SPING VS-109 Channel 7	SAE Criteria		GE Criteria		
	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
	2.92E+02	6.42E+01	2.92E+03	6.42E+02	GAP LOCA
	3.43E+02	9.71E+01	3.43E+03	9.71E+02	DBA LOCA
	3.76E+02	1.04E+02	3.76E+03	1.04E+03	RCS LOCA
	4.28E+02	4.26E+02	4.28E+03	4.26E+03	TID LOCA
	4.17E+02	2.10E+02	4.17E+03	2.10E+03	SB LOCA
	5.15E+02	1.42E+03	5.15E+03	1.42E+04	RCCA
Minimum values =	**6.42E+01**		**6.42E+02**		

SPING VS-109 Channel 9	SAE Criteria		GE Criteria		
	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
	4.89E+00	1.08E+00	4.89E+01	1.08E+01	GAP LOCA
	5.74E+00	1.63E+00	5.74E+01	1.63E+01	DBA LOCA
	5.39E+00	1.49E+00	5.39E+01	1.49E+01	RCS LOCA
	8.74E+00	8.69E+00	8.74E+01	8.69E+01	TID LOCA
	8.06E+00	4.05E+00	8.06E+01	4.05E+01	SB LOCA
	8.66E+00	2.39E+01	8.66E+01	2.39E+02	RCCA
Minimum values =	**1.08E+00**		**1.08E+01**		

VS-111 LR SA10	SAE Criteria		GE Criteria		
	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
	3.08E+04	6.76E+03	3.08E+05	6.76E+04	GAP LOCA
	3.61E+04	1.02E+04	3.61E+05	1.02E+05	DBA LOCA
	3.73E+04	1.03E+04	3.73E+05	1.03E+05	RCS LOCA
	4.73E+04	4.71E+04	4.73E+05	4.71E+05	TID LOCA
	4.54E+04	2.28E+04	4.54E+05	2.28E+05	SB LOCA
	5.43E+04	1.50E+05	5.43E+05	1.50E+06	RCCA
Minimum values =	**6.76E+03**		**6.76E+04**		

VS-111 HR SA9	SAE Criteria		GE Criteria		
	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
	3.51E+00	7.70E-01	3.51E+01	7.70E+00	GAP LOCA
	4.11E+00	1.17E+00	4.11E+01	1.17E+01	DBA LOCA
	3.86E+00	1.07E+00	3.86E+01	1.07E+01	RCS LOCA
	6.26E+00	6.22E+00	6.26E+01	6.22E+01	TID LOCA
	5.77E+00	2.90E+00	5.77E+01	2.90E+01	SB LOCA
	6.20E+00	1.71E+01	6.20E+01	1.71E+02	RCCA
Minimum values =	**7.70E-01**		**7.70E+00**		

VS-101B Victoreen	SAE Criteria		GE Criteria		
	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
	7.68E+06	1.69E+06	7.68E+07	1.69E+07	GAP LOCA
	9.00E+06	2.55E+06	9.00E+07	2.55E+07	DBA LOCA
	1.01E+07	2.80E+06	1.01E+08	2.80E+07	RCS LOCA
	4.86E+06	4.83E+06	4.86E+07	4.83E+07	TID LOCA
	8.95E+06	4.50E+06	8.95E+07	4.50E+07	SB LOCA
	1.32E+07	3.64E+07	1.32E+08	3.64E+08	RCCA
Minimum values =	**1.69E+06**		**1.69E+07**		

Evaluation Summary – Release Point 2, SLCRS:

	SAE Criteria 100 TEDE	SAE Criteria 500 Ch Thy	GE Criteria 1000 TEDE	GE Criteria 5000 Ch Thy	
SPING VS-110 Channel 5	8.40E+06	1.85E+06	8.40E+07	1.85E+07	GAP LOCA
	9.60E+06	2.72E+06	9.60E+07	2.72E+07	DBA LOCA
	6.41E+07	1.77E+07	6.41E+08	1.77E+08	RCS LOCA
	2.38E+06	2.36E+06	2.38E+07	2.36E+07	TID LOCA
	6.95E+06	3.50E+06	6.95E+07	3.50E+07	SB LOCA
	3.10E+07	7.34E+07	3.10E+08	7.34E+08	FHA
	1.43E+07	3.95E+07	1.43E+08	3.95E+08	RCCA
Minimum values =	**1.85E+06**		**1.85E+07**		

	SAE Criteria 100 TEDE	SAE Criteria 500 Ch Thy	GE Criteria 1000 TEDE	GE Criteria 5000 Ch Thy	
SPING VS-110 Channel 7	3.49E+02	7.66E+01	3.49E+03	7.66E+02	GAP LOCA
	4.09E+02	1.16E+02	4.09E+03	1.16E+03	DBA LOCA
	4.49E+02	1.24E+02	4.49E+03	1.24E+03	RCS LOCA
	5.11E+02	5.09E+02	5.11E+03	5.09E+03	TID LOCA
	4.98E+02	2.50E+02	4.98E+03	2.50E+03	SB LOCA
	6.73E+02	1.60E+03	6.73E+03	1.60E+04	FHA
	6.15E+02	1.70E+03	6.15E+03	1.70E+04	RCCA
Minimum values =	**7.66E+01**		**7.66E+02**		

	SAE Criteria 100 TEDE	SAE Criteria 500 Ch Thy	GE Criteria 1000 TEDE	GE Criteria 5000 Ch Thy	
SPING VS-110 Channel 9	8.46E+00	1.86E+00	8.46E+01	1.86E+01	GAP LOCA
	9.91E+00	2.81E+00	9.91E+01	2.81E+01	DBA LOCA
	9.31E+00	2.57E+00	9.31E+01	2.57E+01	RCS LOCA
	1.51E+01	1.50E+01	1.51E+02	1.50E+02	TID LOCA
	1.39E+01	7.00E+00	1.39E+02	7.00E+01	SB LOCA
	1.13E+01	2.68E+01	1.13E+02	2.68E+02	FHA
	1.50E+01	4.14E+01	1.50E+02	4.14E+02	RCCA
Minimum values =	**1.86E+00**		**1.86E+01**		

	SAE Criteria 100 TEDE	SAE Criteria 500 Ch Thy	GE Criteria 1000 TEDE	GE Criteria 5000 Ch Thy	
VS-112 LR SA10	4.94E+04	1.09E+04	4.94E+05	1.09E+05	GAP LOCA
	5.80E+04	1.64E+04	5.80E+05	1.64E+05	DBA LOCA
	6.05E+04	1.67E+04	6.05E+05	1.67E+05	RCS LOCA
	7.63E+04	7.59E+04	7.63E+05	7.59E+05	TID LOCA
	7.35E+04	3.69E+04	7.35E+05	3.69E+05	SB LOCA
	8.98E+04	2.13E+05	8.98E+05	2.13E+06	FHA
	8.71E+04	2.41E+05	8.71E+05	2.41E+06	RCCA
Minimum values =	**1.09E+04**		**1.09E+05**		

	SAE Criteria 100 TEDE	SAE Criteria 500 Ch Thy	GE Criteria 1000 TEDE	GE Criteria 5000 Ch Thy	
VS-112 HR SA9	5.68E+00	1.25E+00	5.68E+01	1.25E+01	GAP LOCA
	6.66E+00	1.89E+00	6.66E+01	1.89E+01	DBA LOCA
	6.26E+00	1.73E+00	6.26E+01	1.73E+01	RCS LOCA
	1.01E+01	1.01E+01	1.01E+02	1.01E+02	TID LOCA
	9.35E+00	4.70E+00	9.35E+01	4.70E+01	SB LOCA
	7.59E+00	1.80E+01	7.59E+01	1.80E+02	FHA
	1.01E+01	2.78E+01	1.01E+02	2.78E+02	RCCA
Minimum values =	**1.25E+00**		**1.25E+01**		

	SAE Criteria 100 TEDE	SAE Criteria 500 Ch Thy	GE Criteria 1000 TEDE	GE Criteria 5000 Ch Thy	
VS-107B Victoreen	1.51E+07	3.31E+06	1.51E+08	3.31E+07	GAP LOCA
	1.72E+07	4.88E+06	1.72E+08	4.88E+07	DBA LOCA
	1.18E+08	3.25E+07	1.18E+09	3.25E+08	RCS LOCA
	6.34E+06	6.31E+06	6.34E+07	6.31E+07	TID LOCA
	1.32E+07	6.61E+06	1.32E+08	6.61E+07	SB LOCA
	5.34E+07	1.27E+08	5.34E+08	1.27E+09	FHA
	2.58E+07	7.11E+07	2.58E+08	7.11E+08	RCCA
Minimum values =	**3.31E+06**		**3.31E+07**		

Evaluation Summary – Release Point 3, Process Vent:

	SAE Criteria		GE Criteria		
	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
SPING GW-109 Channel 7	8.08E+05	1.06E+06	8.08E+06	1.06E+07	SGTR
	8.59E+05	N/A	8.59E+06	N/A	WGSR
Minimum values =	**8.08E+05**		**8.08E+06**		

	SAE Criteria		GE Criteria		
	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
SPING GW-109 Channel 9	1.72E+04	2.25E+04	1.72E+05	2.25E+05	SGTR
	1.76E+04	N/A	1.76E+05	N/A	WGSR
Minimum values =	**1.72E+04**		**1.72E+05**		

	SAE Criteria		GE Criteria		
	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
GW-110 LR SA10	1.09E+08	1.43E+08	1.09E+09	1.43E+09	SGTR
	1.14E+08	N/A	1.14E+09	N/A	WGSR
Minimum values =	**1.09E+08**		**1.09E+09**		

	SAE Criteria		GE Criteria		
	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
GW-110 HR SA9	1.49E+04	1.96E+04	1.49E+05	1.96E+05	SGTR
	1.53E+04	N/A	1.53E+05	N/A	WGSR
Minimum values =	**1.49E+04**		**1.49E+05**		

	SAE Criteria		GE Criteria		
	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
VS-108B Victoreen	1.99E+10	2.62E+10	1.99E+11	2.62E+11	SGTR
	2.21E+10	N/A	2.21E+11	N/A	WGSR
Minimum values =	**1.99E+10**		**1.99E+11**		

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

Subject: **BVPS-U1 Gaseous Radioactivity Monitor Emergency Action Levels**

No.: **ERS-MPD-93-007 Attachment 3**

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X/Q = 1.03E-04 s/m^3

Monitor efficiencies from ERS-SFL-85-031 Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01) Release (uCi/s) CF for TEDE = 1.17E+05 (Expression 5)

SPING VS-109 Channel 5 Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s Release (uCi/s) CF for Child Thyroid = 5.16E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.37E+02	8.11E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E+01	3.58E-07	0.00E+00	0.00E+00
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	5.82E+02	1.99E-05	2.39E+07	4.75E+02	0.00E+00	0.00E+00	2.56E+01	8.74E-07	2.39E+07	2.09E+01
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.34E+03	1.14E-04	2.47E+07	2.82E+03	0.00E+00	0.00E+00	1.47E+02	5.02E-06	2.47E+07	1.24E+02
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.22E+02	7.60E-06	2.95E+07	2.25E+02	0.00E+00	0.00E+00	9.78E+00	3.34E-07	2.95E+07	9.86E+00
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	9.43E+02	3.22E-05	2.11E+07	6.80E+02	0.00E+00	0.00E+00	4.14E+01	1.42E-06	2.11E+07	2.99E+01
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	1.97E-01	6.75E-09	2.93E+07	1.98E-01	0.00E+00	0.00E+00	8.68E-03	2.96E-10	2.93E+07	8.68E-03
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	1.91E+03	6.53E-05	1.56E+07	1.02E+03	0.00E+00	0.00E+00	8.40E+01	2.87E-06	1.56E+07	4.48E+01
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.67E+03	5.70E-05	1.94E+07	1.10E+03	0.00E+00	0.00E+00	7.32E+01	2.50E-06	1.94E+07	4.84E+01
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	9.79E+04	3.35E-03	1.24E+07	4.14E+04	0.00E+00	0.00E+00	4.30E+03	1.47E-04	1.24E+07	1.82E+03
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.26E+03	1.12E-04	5.70E+06	6.36E+02	0.00E+00	0.00E+00	1.43E+02	4.90E-06	5.70E+06	2.80E+01
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.14E+03	2.44E-04	2.91E+07	7.10E+03	0.00E+00	0.00E+00	3.14E+02	1.07E-05	2.91E+07	3.12E+02
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	6.71E-01	2.29E-08	2.96E+07	6.78E-01	0.00E+00	0.00E+00	2.95E-02	1.01E-09	2.96E+07	2.98E-02
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.05E+01	7.02E-07	2.66E+07	1.86E+01	0.00E+00	0.00E+00	9.02E-01	3.08E-08	2.66E+07	8.19E-01
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	7.19E+01	2.46E-06	9.42E+05	2.31E+00	2.44E+07	1.49E+04	3.16E+00	1.08E-07	9.42E+05	1.02E-01
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.48E+01	1.19E-06	1.44E+06	1.71E+00	2.90E+05	8.58E+01	1.53E+00	5.22E-08	1.44E+06	7.51E-02
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	2.79E+01	9.54E-07	1.45E+06	1.38E+00	5.77E+06	1.37E+03	1.23E+00	4.19E-08	1.45E+06	6.08E-02
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.71E+00	5.86E-08	1.49E+06	8.71E-02	7.60E+04	1.11E+00	7.53E-02	2.57E-09	1.49E+06	3.83E-03
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	8.90E+00	3.04E-07	1.32E+06	4.00E-01	1.19E+06	9.02E+01	3.91E-01	1.34E-08	1.32E+06	1.76E-02
	4.46E+04			7.24E+02				5.65E+04		1.65E+04		1.76E-04		2.44E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	5.55E+06	5.00E+02	1.22E+06
5.00E+01	2.77E+06	2.50E+02	6.09E+05
1.00E+03	5.55E+07	5.00E+03	1.22E+07

X/Q = 1.03E-04 s/m^3

Monitor efficiencies from ERS-SFL-85-031 Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01) Release (uCi/s) CF for TEDE = 1.36E+05 (Expression 5)

SPING VS-109 Channel 5 Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s Release (uCi/s) CF for Child Thyroid = 7.70E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	2.78E+02	9.51E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E+01	5.39E-07	0.00E+00	0.00E+00
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	6.82E+02	2.33E-05	2.39E+07	5.56E+02	0.00E+00	0.00E+00	3.87E+01	1.32E-06	2.39E+07	3.15E+01
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	1.96E+03	6.71E-05	2.47E+07	1.66E+03	0.00E+00	0.00E+00	1.11E+02	3.80E-06	2.47E+07	9.40E+01
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.61E+02	8.93E-06	2.95E+07	2.64E+02	0.00E+00	0.00E+00	1.48E+01	5.06E-07	2.95E+07	1.50E+01
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.11E+03	3.78E-05	2.11E+07	7.98E+02	0.00E+00	0.00E+00	6.28E+01	2.14E-06	2.11E+07	4.53E+01
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.32E-01	7.92E-09	2.93E+07	2.32E-01	0.00E+00	0.00E+00	1.31E-02	4.49E-10	2.93E+07	1.32E-02
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.24E+03	7.66E-05	1.56E+07	1.20E+03	0.00E+00	0.00E+00	1.27E+02	4.34E-06	1.56E+07	6.78E+01
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	1.96E+03	6.71E-05	1.94E+07	1.30E+03	0.00E+00	0.00E+00	1.11E+02	3.80E-06	1.94E+07	7.37E+01
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.15E+05	3.92E-03	1.24E+07	4.85E+04	0.00E+00	0.00E+00	6.51E+03	2.23E-04	1.24E+07	2.75E+03
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	3.83E+03	1.31E-04	5.70E+06	7.47E+02	0.00E+00	0.00E+00	2.17E+02	7.43E-06	5.70E+06	4.24E+01
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	8.38E+03	2.86E-04	2.91E+07	8.33E+03	0.00E+00	0.00E+00	4.75E+02	1.62E-05	2.91E+07	4.72E+02
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	7.87E-01	2.69E-08	2.96E+07	7.95E-01	0.00E+00	0.00E+00	4.46E-02	1.52E-09	2.96E+07	4.51E-02
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.41E+01	8.24E-07	2.66E+07	2.19E+01	0.00E+00	0.00E+00	1.37E+00	4.67E-08	2.66E+07	1.24E+00
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.27E+01	1.80E-06	9.42E+05	1.70E+00	2.44E+07	9.48E+03	2.99E+00	1.02E-07	9.42E+05	9.63E-02
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.08E+01	1.39E-06	1.44E+06	2.01E+00	2.90E+05	8.72E+01	2.31E+00	7.91E-08	1.44E+06	1.14E-01
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.28E+01	1.12E-06	1.45E+06	1.62E+00	5.77E+06	1.39E+03	1.86E+00	6.35E-08	1.45E+06	9.22E-02
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.01E+00	6.87E-08	1.49E+06	1.02E-01	7.60E+04	1.13E+00	1.14E-01	3.89E-09	1.49E+06	5.79E-03
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.04E+01	3.57E-07	1.32E+06	4.69E-01	1.19E+06	9.15E+01	5.92E-01	2.02E-08	1.32E+06	2.66E-02
	8.78E+05			6.27E+02				6.34E+04		1.10E+04		2.63E-04		3.59E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	6.34E+06	5.00E+02	1.80E+06
5.00E+01	3.17E+06	2.50E+02	8.99E+05
1.00E+03	6.34E+07	5.00E+03	1.80E+07

Monitor efficiencies from ERS-SFL-85-031
SPING VS-109 Channel 5

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
Release Flow Rate = 6.20E+04 cfm 2.93E+07 cc/s

X/Q = 1.03E-04 s/m^3
Release (uCi/s) CF for TEDE = 6.41E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.54E+04 (Expression 5)

Isotope	U1 only LOCA RCS (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.46E+01	4.98E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.06E-01	2.75E-08	0.00E+00	0.00E+00
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.02E+01	2.06E-06	2.39E+07	4.91E+01	0.00E+00	0.00E+00	3.32E+00	1.14E-07	2.39E+07	2.71E+00
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.56E+05	1.22E-02	2.47E+07	3.01E+05	0.00E+00	0.00E+00	1.97E+04	6.72E-04	2.47E+07	1.66E+04
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	7.66E+00	2.62E-07	2.95E+07	7.73E+00	0.00E+00	0.00E+00	4.23E-01	1.45E-08	2.95E+07	4.27E-01
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	6.55E+01	2.24E-06	2.11E+07	4.72E+01	0.00E+00	0.00E+00	3.62E+00	1.24E-07	2.11E+07	2.61E+00
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.18E-04	1.09E-11	2.93E+07	3.18E-04	0.00E+00	0.00E+00	1.76E-05	6.00E-13	2.93E+07	1.76E-05
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.28E+04	4.39E-04	1.56E+07	6.85E+03	0.00E+00	0.00E+00	7.09E+02	2.42E-05	1.56E+07	3.79E+02
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	1.97E+03	6.73E-05	1.94E+07	1.30E+03	0.00E+00	0.00E+00	1.09E+02	3.72E-06	1.94E+07	7.20E+01
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	2.70E+05	9.22E-03	1.24E+07	1.14E+05	0.00E+00	0.00E+00	1.49E+04	5.09E-04	1.24E+07	6.30E+03
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.32E+02	4.50E-06	5.70E+06	2.57E+01	0.00E+00	0.00E+00	7.27E+00	2.49E-07	5.70E+06	1.42E+00
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.02E+02	6.92E-06	2.91E+07	2.01E+02	0.00E+00	0.00E+00	1.12E+01	3.82E-07	2.91E+07	1.11E+01
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.29E-03	4.42E-11	2.96E+07	1.31E-03	0.00E+00	0.00E+00	7.15E-05	2.44E-12	2.96E+07	7.23E-05
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.44E-01	4.91E-09	2.66E+07	1.30E-01	0.00E+00	0.00E+00	7.94E-03	2.71E-10	2.66E+07	7.21E-03
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	5.89E+01	2.01E-06	9.42E+05	1.90E+00	2.44E+07	2.24E+03	3.25E+00	1.11E-07	9.42E+05	1.05E-01
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	3.94E+01	1.35E-06	1.44E+06	1.94E+00	2.90E+05	1.78E+01	2.18E+00	7.44E-08	1.44E+06	1.07E-01
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.50E+01	5.13E-07	1.45E+06	7.45E-01	5.77E+06	1.35E+02	8.30E-01	2.84E-08	1.45E+06	4.11E-02
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	3.93E-01	1.34E-08	1.49E+06	2.00E-02	7.60E+04	4.66E-02	2.17E-02	7.42E-10	1.49E+06	1.10E-03
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.09E+00	1.40E-07	1.32E+06	1.84E-01	1.19E+06	7.59E+00	2.26E-01	7.72E-09	1.32E+06	1.02E-02
	5.89E+01			1.33E+02				4.23E+05		2.40E+03		1.21E-03		2.34E+04

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.23E+07	5.00E+02	1.17E+07
5.00E+01	2.12E+07	2.50E+02	5.84E+06
1.00E+03	4.23E+08	5.00E+03	1.17E+08

Monitor efficiencies from ERS-SFL-85-031
SPING VS-109 Channel 5

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.005)
Release Flow Rate = 6.20E+04 cfm 2.93E+07 cc/s

X/Q = 1.03E-04 s/m^3
Release (uCi/s) CF for TEDE = 2.03E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 4.04E+03 (Expression 5)

Isotope	U1 only LOCA TID (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.65E+02	9.07E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.28E+01	1.80E-06	0.00E+00	0.00E+00
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	5.47E+02	1.87E-05	2.39E+07	4.46E+02	0.00E+00	0.00E+00	1.09E+02	3.72E-06	2.39E+07	8.87E+01
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.32E+01	7.92E-07	2.47E+07	1.96E+01	0.00E+00	0.00E+00	4.61E+00	1.58E-07	2.47E+07	3.90E+00
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.10E+03	3.75E-05	2.95E+07	1.11E+03	0.00E+00	0.00E+00	2.18E+02	7.45E-06	2.95E+07	2.20E+02
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.52E+03	5.20E-05	2.11E+07	1.10E+03	0.00E+00	0.00E+00	3.03E+02	1.04E-05	2.11E+07	2.18E+02
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	1.89E+03	6.47E-05	2.93E+07	1.89E+03	0.00E+00	0.00E+00	3.77E+02	1.29E-05	2.93E+07	3.77E+02
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.03E+01	1.03E-06	1.56E+07	1.62E+01	0.00E+00	0.00E+00	6.03E+00	2.06E-07	1.56E+07	3.22E+00
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.42E+02	4.84E-06	1.94E+07	9.37E+01	0.00E+00	0.00E+00	2.82E+01	9.63E-07	1.94E+07	1.86E+01
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	4.49E+03	1.53E-04	1.24E+07	1.90E+03	0.00E+00	0.00E+00	8.93E+02	3.05E-05	1.24E+07	3.77E+02
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	9.42E+02	3.22E-05	5.70E+06	1.84E+02	0.00E+00	0.00E+00	1.87E+02	6.41E-06	5.70E+06	3.65E+01
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.36E+03	4.64E-05	2.91E+07	1.35E+03	0.00E+00	0.00E+00	2.70E+02	9.23E-06	2.91E+07	2.69E+02
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.09E+03	1.40E-04	2.96E+07	4.14E+03	0.00E+00	0.00E+00	8.15E+02	2.78E-05	2.96E+07	8.23E+02
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	3.81E+03	1.30E-04	2.66E+07	3.46E+03	0.00E+00	0.00E+00	7.59E+02	2.59E-05	2.66E+07	6.89E+02
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.09E+01	3.73E-07	9.42E+05	3.51E-01	2.44E+07	1.31E+04	2.17E+00	7.42E-08	9.42E+05	6.99E-02
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.60E+01	5.46E-07	1.44E+06	7.87E-01	2.90E+05	2.28E+02	3.16E+00	1.09E-07	1.44E+06	1.56E-01
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.24E+01	7.67E-07	1.45E+06	1.11E+00	5.77E+06	6.37E+03	4.46E+00	1.53E-07	1.45E+06	2.21E-01
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.48E+01	8.48E-07	1.49E+06	1.26E+00	7.60E+04	9.29E+01	4.94E+00	1.69E-07	1.49E+06	2.51E-01
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.13E+01	7.28E-07	1.32E+06	9.58E-01	1.19E+06	1.25E+03	4.24E+00	1.45E-07	1.32E+06	1.91E-01
	7.24E+08			4.19E+03				1.57E+04		2.10E+04		1.38E-04		3.12E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.57E+06	5.00E+02	1.56E+06
5.00E+01	7.85E+05	2.50E+02	7.81E+05
1.00E+03	1.57E+07	5.00E+03	1.56E+07

X/Q = 1.03E-04 s/m³

Monitor efficiencies from ERS-SFL-85-031
SPING VS-109 Channel 5

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

Release (uCi/s) CF for TEDE = 9.40E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 9.45E+03 (Expression 5)

Isotope	U1 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	5.84E+01	2.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.87E+00	2.01E-07	0.00E+00	0.00E+00
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.09E+02	7.13E-06	2.39E+07	1.70E+02	0.00E+00	0.00E+00	2.10E+01	7.17E-07	2.39E+07	1.71E+01
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	1.85E+04	6.33E-04	2.47E+07	1.57E+04	0.00E+00	0.00E+00	1.86E+03	6.36E-05	2.47E+07	1.57E+03
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.32E+02	4.52E-06	2.95E+07	1.33E+02	0.00E+00	0.00E+00	1.33E+01	4.54E-07	2.95E+07	1.34E+01
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	3.85E+02	1.31E-05	2.11E+07	2.77E+02	0.00E+00	0.00E+00	3.87E+01	1.32E-06	2.11E+07	2.79E+01
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.38E+00	1.15E-07	2.93E+07	3.38E+00	0.00E+00	0.00E+00	3.40E-01	1.16E-08	2.93E+07	3.40E-01
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	7.88E+02	2.69E-05	1.56E+07	4.21E+02	0.00E+00	0.00E+00	7.92E+01	2.71E-06	1.56E+07	4.23E+01
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.06E+02	2.41E-05	1.94E+07	4.67E+02	0.00E+00	0.00E+00	7.10E+01	2.42E-06	1.94E+07	4.69E+01
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	4.74E+04	1.62E-03	1.24E+07	2.00E+04	0.00E+00	0.00E+00	4.76E+03	1.63E-04	1.24E+07	2.01E+03
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.09E+04	7.14E-04	5.70E+06	4.07E+03	0.00E+00	0.00E+00	2.10E+03	7.18E-05	5.70E+06	4.09E+02
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	4.69E+03	1.60E-04	2.91E+07	4.68E+03	0.00E+00	0.00E+00	4.72E+02	1.61E-05	2.91E+07	4.69E+02
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.02E+01	3.49E-07	2.96E+07	1.03E+01	0.00E+00	0.00E+00	1.03E+00	3.51E-08	2.96E+07	1.04E+00
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.11E+01	2.43E-06	2.66E+07	6.45E+01	0.00E+00	0.00E+00	7.14E+00	2.44E-07	2.66E+07	6.49E+00
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.33E+01	7.95E-07	9.42E+05	7.49E-01	2.44E+07	6.04E+03	2.34E+00	7.99E-08	9.42E+05	7.53E-02
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.39E+01	8.18E-07	1.44E+06	1.18E+00	2.90E+05	7.38E+01	2.40E+00	8.22E-08	1.44E+06	1.18E-01
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.03E+01	1.38E-06	1.45E+06	2.00E+00	5.77E+06	2.48E+03	4.06E+00	1.39E-07	1.45E+06	2.01E-01
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	2.77E+01	9.46E-07	1.49E+06	1.41E+00	7.60E+04	2.24E+01	2.78E+00	9.51E-08	1.49E+06	1.41E-01
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.07E+01	1.05E-06	1.32E+06	1.38E+00	1.19E+06	3.89E+02	3.09E+00	1.06E-07	1.32E+06	1.39E-01
	4.01E+02			9.05E+02				4.60E+04		9.00E+03		3.23E-04		4.62E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.60E+06	5.00E+02	2.31E+06
5.00E+01	2.30E+06	2.50E+02	1.15E+06
1.00E+03	4.60E+07	5.00E+03	2.31E+07

X/Q = 1.03E-04 s/m³

Monitor efficiencies from ERS-SFL-85-031
SPING VS-109 Channel 5

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

Release (uCi/s) CF for TEDE = 1.98E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.09E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	4.89E+02	1.67E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.70E+02	9.23E-06	0.00E+00	0.00E+00
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.17E+03	3.99E-05	2.39E+07	9.52E+02	0.00E+00	0.00E+00	6.45E+02	2.20E-05	2.39E+07	5.26E+02
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	2.84E+03	9.71E-05	2.47E+07	2.40E+03	0.00E+00	0.00E+00	1.57E+03	5.37E-05	2.47E+07	1.33E+03
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	6.68E+02	2.28E-05	2.95E+07	6.74E+02	0.00E+00	0.00E+00	3.69E+02	1.26E-05	2.95E+07	3.73E+02
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.09E+03	7.13E-05	2.11E+07	1.50E+03	0.00E+00	0.00E+00	1.15E+03	3.94E-05	2.11E+07	8.31E+02
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	4.81E+01	1.65E-06	2.93E+07	4.82E+01	0.00E+00	0.00E+00	2.66E+01	9.09E-07	2.93E+07	2.66E+01
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.38E+03	8.14E-05	1.56E+07	1.27E+03	0.00E+00	0.00E+00	1.32E+03	4.50E-05	1.56E+07	7.02E+02
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	2.86E+03	9.76E-05	1.94E+07	1.89E+03	0.00E+00	0.00E+00	1.58E+03	5.39E-05	1.94E+07	1.04E+03
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.69E+05	5.78E-03	1.24E+07	7.14E+04	0.00E+00	0.00E+00	9.34E+04	3.19E-03	1.24E+07	3.94E+04
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	1.82E+03	6.21E-05	5.70E+06	3.54E+02	0.00E+00	0.00E+00	1.00E+03	3.43E-05	5.70E+06	1.98E+02
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.36E+04	4.64E-04	2.91E+07	1.35E+04	0.00E+00	0.00E+00	7.50E+03	2.56E-04	2.91E+07	7.46E+03
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.24E+02	4.24E-06	2.96E+07	1.25E+02	0.00E+00	0.00E+00	6.85E+01	2.34E-06	2.96E+07	6.92E+01
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.33E+02	1.48E-05	2.66E+07	3.93E+02	0.00E+00	0.00E+00	2.39E+02	8.17E-06	2.66E+07	2.17E+02
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	5.80E+00	1.98E-07	9.42E+05	1.87E-01	2.44E+07	7.17E+02	3.20E+00	1.10E-07	9.42E+05	1.03E-01
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.00E-01	6.83E-09	1.44E+06	9.83E-03	2.90E+05	2.93E-01	1.10E-01	3.77E-09	1.44E+06	5.43E-03
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	1.98E+00	6.78E-08	1.45E+06	9.84E-02	5.77E+06	5.80E+01	1.10E+00	3.75E-08	1.45E+06	5.44E-02
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.19E-01	4.06E-09	1.49E+06	6.04E-03	7.60E+04	4.58E-02	6.57E-02	2.25E-09	1.49E+06	3.34E-03
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	7.43E-01	2.54E-08	1.32E+06	3.34E-02	1.19E+06	4.47E+00	4.10E-01	1.40E-08	1.32E+06	1.84E-02
	1.54E+04			4.31E+02				9.45E+04		7.79E+02		3.73E-03		5.22E+04

TEDE	cpm	Child Thyroid	cpm
1.00E+02	9.45E+06	5.00E+02	2.61E+07
5.00E+01	4.72E+06	2.50E+02	1.31E+07
1.00E+03	9.45E+07	5.00E+03	2.61E+08

Monitor efficiencies from ERS-SFL-85-031
SPING VS-109 Channel 7

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m³
Release (uCi/s) CF for TEDE = 1.17E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 5.16E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.37E+02	8.11E-06	2.43E+01	1.97E-04	0.00E+00	0.00E+00	1.04E+01	3.56E-07	2.43E+01	8.67E-06
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	5.82E+02	1.99E-05	1.48E+03	2.93E-02	0.00E+00	0.00E+00	2.56E+01	8.74E-07	1.48E+03	1.29E-03
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.34E+03	1.14E-04	2.57E+01	2.94E-03	0.00E+00	0.00E+00	1.47E+02	5.02E-06	2.57E+01	1.29E-04
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.22E+02	7.60E-06	7.42E+03	5.64E-02	0.00E+00	0.00E+00	9.78E+00	3.34E-07	7.42E+03	2.48E-03
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	9.43E+02	3.22E-05	1.83E+04	5.89E-01	0.00E+00	0.00E+00	4.14E+01	1.42E-06	1.83E+04	2.59E-02
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	1.97E-01	6.75E-09	1.72E+04	1.16E-04	0.00E+00	0.00E+00	8.68E-03	2.96E-10	1.72E+04	5.09E-06
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	1.91E+03	6.53E-05	1.88E+02	1.23E-02	0.00E+00	0.00E+00	8.40E+01	2.87E-06	1.88E+02	5.40E-04
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.67E+03	5.70E-05	3.88E+02	2.21E-02	0.00E+00	0.00E+00	7.32E+01	2.50E-06	3.88E+02	9.72E-04
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	9.79E+04	3.35E-03	3.54E+02	1.18E+00	0.00E+00	0.00E+00	4.30E+03	1.47E-04	3.54E+02	5.20E-02
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.26E+03	1.12E-04	4.03E+03	4.50E-01	0.00E+00	0.00E+00	1.43E+02	4.90E-06	4.03E+03	1.98E-02
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.14E+03	2.44E-04	2.32E+03	5.66E-01	0.00E+00	0.00E+00	3.14E+02	1.07E-05	2.32E+03	2.49E-02
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	6.71E-01	2.29E-08	1.76E+03	4.03E-05	0.00E+00	0.00E+00	2.95E-02	1.01E-09	1.76E+03	1.77E-06
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.05E+01	7.02E-07	1.05E+04	7.40E-03	0.00E+00	0.00E+00	9.02E-01	3.08E-08	1.05E+04	3.25E-04
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	7.19E+01	2.46E-06	1.78E+02	4.38E-04	2.44E+07	1.49E+04	3.16E+00	1.08E-07	1.78E+02	1.92E-05
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.48E+01	1.19E-06	1.07E+03	1.27E-03	2.90E+05	8.58E+01	1.53E+00	5.22E-08	1.07E+03	5.59E-05
I-133	1.08E+01	2.38E-04	1.28E+05	3.04E+01	2.79E+01	9.54E-07	2.84E+02	2.71E-04	5.77E+06	1.37E+03	1.23E+00	4.19E-08	2.84E+02	1.19E-05
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.71E+00	5.86E-08	1.23E+03	7.19E-05	7.60E+04	1.11E+00	7.53E-02	2.57E-09	1.23E+03	3.16E-06
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	8.90E+00	3.04E-07	7.37E+02	2.24E-04	1.19E+06	9.02E+01	3.91E-01	1.34E-08	7.37E+02	9.85E-06
	4.46E+04			7.24E+02				2.92E+00		1.65E+04		1.76E-04		1.28E-01

TEDE	cpm	-	Child Thyroid	cpm
1.00E+02	2.92E+02		5.00E+02	6.42E+01
5.00E+01	1.46E+02		2.50E+02	3.21E+01
1.00E+03	2.92E+03		5.00E+03	6.42E+02

Monitor efficiencies from ERS-SFL-85-031
SPING VS-109 Channel 7

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m³
Release (uCi/s) CF for TEDE = 1.36E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 7.70E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	2.78E+02	9.51E-06	2.43E+01	2.31E-04	0.00E+00	0.00E+00	1.58E+01	5.39E-07	2.43E+01	1.31E-05
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	6.82E+02	2.33E-05	1.48E+03	3.44E-02	0.00E+00	0.00E+00	3.87E+01	1.32E-06	1.48E+03	1.95E-03
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	1.96E+03	6.71E-05	2.57E+01	1.72E-03	0.00E+00	0.00E+00	1.11E+02	3.80E-06	2.57E+01	9.78E-05
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.61E+02	8.93E-06	7.42E+03	6.62E-02	0.00E+00	0.00E+00	1.48E+01	5.06E-07	7.42E+03	3.76E-03
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.11E+03	3.78E-05	1.83E+04	6.92E-01	0.00E+00	0.00E+00	6.28E+01	2.14E-06	1.83E+04	3.92E-02
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.32E-01	7.92E-09	1.72E+04	1.36E-04	0.00E+00	0.00E+00	1.31E-02	4.49E-10	1.72E+04	7.72E-06
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.24E+03	7.66E-05	1.88E+02	1.44E-02	0.00E+00	0.00E+00	1.27E+02	4.34E-06	1.88E+02	8.17E-04
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	1.96E+03	6.71E-05	3.88E+02	2.60E-02	0.00E+00	0.00E+00	1.11E+02	3.80E-06	3.88E+02	1.48E-03
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.15E+05	3.92E-03	3.54E+02	1.39E+00	0.00E+00	0.00E+00	6.51E+03	2.23E-04	3.54E+02	7.87E-02
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	3.83E+03	1.31E-04	4.03E+03	5.28E-01	0.00E+00	0.00E+00	2.17E+02	7.43E-06	4.03E+03	2.99E-02
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	8.38E+03	2.86E-04	2.32E+03	6.64E-01	0.00E+00	0.00E+00	4.75E+02	1.62E-05	2.32E+03	3.77E-02
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	7.87E-01	2.69E-08	1.76E+03	4.72E-05	0.00E+00	0.00E+00	4.46E-02	1.52E-09	1.76E+03	2.68E-06
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.41E+01	8.24E-07	1.05E+04	8.69E-03	0.00E+00	0.00E+00	1.37E+00	4.67E-08	1.05E+04	4.93E-04
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.27E+01	1.80E-06	1.78E+02	3.21E-04	2.44E+07	9.48E+03	2.99E+00	1.02E-07	1.78E+02	1.82E-05
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.08E+01	1.39E-06	1.07E+03	1.49E-03	2.90E+05	8.72E+01	2.31E+00	7.91E-08	1.07E+03	8.48E-05
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.28E+01	1.12E-06	2.84E+02	3.18E-04	5.77E+06	1.39E+03	1.86E+00	6.35E-08	2.84E+02	1.80E-05
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.01E+00	6.87E-08	1.23E+03	8.43E-05	7.60E+04	1.13E+00	1.14E-01	3.89E-09	1.23E+03	4.78E-06
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.04E+01	3.57E-07	7.37E+02	2.63E-04	1.19E+06	9.15E+01	5.92E-01	2.02E-08	7.37E+02	1.49E-05
	8.78E+05			6.27E+02				3.43E+00		1.10E+04		2.63E-04		1.94E-01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	3.43E+02	5.00E+02	9.71E+01
5.00E+01	1.71E+02	2.50E+02	4.86E+01
1.00E+03	3.43E+03	5.00E+03	9.71E+02

Monitor efficiencies from ERS-SFL-85-031
SPING VS-109 Channel 7
Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s
X/Q = 1.03E-04 s/m³
Release (uCi/s) CF for TEDE = 6.41E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.54E+04 (Expression 5)

Isotope	U1 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.46E+01	4.98E-07	2.43E+01	1.21E-05	0.00E+00	0.00E+00	8.06E-01	2.75E-08	2.43E+01	6.70E-07
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.02E+01	2.06E-06	1.48E+03	3.04E-03	0.00E+00	0.00E+00	3.32E+00	1.14E-07	1.48E+03	1.88E-04
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.56E+05	1.22E-02	2.57E+01	3.13E-01	0.00E+00	0.00E+00	1.97E+04	6.72E-04	2.57E+01	1.73E-02
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	7.66E+00	2.62E-07	7.42E+03	1.94E-03	0.00E+00	0.00E+00	4.23E-01	1.45E-08	7.42E+03	1.07E-04
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	6.55E+01	2.24E-06	1.83E+04	4.09E-02	0.00E+00	0.00E+00	3.62E+00	1.24E-07	1.83E+04	2.26E-03
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.18E-04	1.09E-11	1.72E+04	1.86E-07	0.00E+00	0.00E+00	1.76E-05	6.00E-13	1.72E+04	1.03E-08
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.28E+04	4.39E-04	1.88E+02	8.26E-02	0.00E+00	0.00E+00	7.09E+02	2.42E-05	1.88E+02	4.56E-03
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	1.97E+03	6.73E-05	3.88E+02	2.61E-02	0.00E+00	0.00E+00	1.09E+02	3.72E-06	3.88E+02	1.44E-03
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	2.70E+05	9.22E-03	3.54E+02	3.26E+00	0.00E+00	0.00E+00	1.49E+04	5.09E-04	3.54E+02	1.80E-01
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.32E+02	4.50E-06	4.03E+03	1.81E-02	0.00E+00	0.00E+00	7.27E+00	2.49E-07	4.03E+03	1.00E-03
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.02E+02	6.92E-06	2.32E+03	1.60E-02	0.00E+00	0.00E+00	1.12E+01	3.82E-07	2.32E+03	8.87E-04
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.29E-03	4.42E-11	1.76E+03	7.77E-08	0.00E+00	0.00E+00	7.15E-05	2.44E-12	1.76E+03	4.29E-09
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.44E-01	4.91E-09	1.05E+04	5.17E-05	0.00E+00	0.00E+00	7.94E-03	2.71E-10	1.05E+04	2.86E-06
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	5.89E+01	2.01E-06	1.78E+02	3.59E-04	2.44E+07	2.24E+03	3.25E+00	1.11E-07	1.78E+02	1.98E-05
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	3.94E+01	1.35E-06	1.07E+03	1.44E-03	2.90E+05	1.78E+01	2.18E+00	7.44E-08	1.07E+03	7.97E-05
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.50E+01	5.13E-07	2.84E+02	1.46E-04	5.77E+06	1.35E+02	8.30E-01	2.84E-08	2.84E+02	8.05E-06
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	3.93E-01	1.34E-08	1.23E+03	1.65E-05	7.60E+04	4.66E-02	2.17E-02	7.42E-10	1.23E+03	9.11E-07
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.09E+00	1.40E-07	7.37E+02	1.03E-04	1.19E+06	7.59E+00	2.26E-01	7.72E-09	7.37E+02	5.69E-06
	5.89E+01			1.33E+02				3.76E+00		2.40E+03		1.21E-03		2.08E-01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	3.76E+02	5.00E+02	1.04E+02
5.00E+01	1.88E+02	2.50E+02	5.20E+01
1.00E+03	3.76E+03	5.00E+03	1.04E+03

Monitor efficiencies from ERS-SFL-85-031
SPING VS-109 Channel 7
Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.005)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s
X/Q = 1.03E-04 s/m³
Release (uCi/s) CF for TEDE = 2.03E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 4.04E+03 (Expression 5)

Isotope	U1 only LOCA TID (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.65E+02	9.07E-06	2.43E+01	2.21E-04	0.00E+00	0.00E+00	5.28E+01	1.80E-06	2.43E+01	4.39E-05
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	5.47E+02	1.87E-05	1.48E+03	2.76E-02	0.00E+00	0.00E+00	1.09E+02	3.72E-06	1.48E+03	5.49E-03
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.32E+01	7.92E-07	2.57E+01	2.04E-05	0.00E+00	0.00E+00	4.61E+00	1.58E-07	2.57E+01	4.05E-06
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.10E+03	3.75E-05	7.42E+03	2.78E-01	0.00E+00	0.00E+00	2.18E+02	7.45E-06	7.42E+03	5.53E-02
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.52E+03	5.20E-05	1.83E+04	9.52E-01	0.00E+00	0.00E+00	3.03E+02	1.04E-05	1.83E+04	1.89E-01
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	1.89E+03	6.47E-05	1.72E+04	1.11E+00	0.00E+00	0.00E+00	3.77E+02	1.29E-05	1.72E+04	2.21E-01
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.03E+01	1.03E-06	1.88E+02	1.95E-04	0.00E+00	0.00E+00	6.03E+00	2.06E-07	1.88E+02	3.87E-05
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.42E+02	4.84E-06	3.88E+02	1.88E-03	0.00E+00	0.00E+00	2.82E+01	9.63E-07	3.88E+02	3.74E-04
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	4.49E+03	1.53E-04	3.54E+02	5.42E-02	0.00E+00	0.00E+00	8.93E+02	3.05E-05	3.54E+02	1.08E-02
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	9.42E+02	3.22E-05	4.03E+03	1.30E-01	0.00E+00	0.00E+00	1.87E+02	6.41E-06	4.03E+03	2.58E-02
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.36E+03	4.64E-05	2.32E+03	1.08E-01	0.00E+00	0.00E+00	2.70E+02	9.23E-06	2.32E+03	2.14E-02
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.09E+03	1.40E-04	1.76E+03	2.46E-01	0.00E+00	0.00E+00	8.15E+02	2.78E-05	1.76E+03	4.89E-02
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	3.81E+03	1.30E-04	1.05E+04	1.37E+00	0.00E+00	0.00E+00	7.59E+02	2.59E-05	1.05E+04	2.73E-01
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.09E+01	3.73E-07	1.78E+02	6.65E-05	2.44E+07	1.31E+04	2.17E+00	7.42E-08	1.78E+02	1.32E-05
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.60E+01	5.48E-07	1.07E+03	5.86E-04	2.90E+05	2.28E+02	3.18E+00	1.09E-07	1.07E+03	1.16E-04
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.24E+01	7.67E-07	2.84E+02	2.18E-04	5.77E+06	6.37E+03	4.46E+00	1.53E-07	2.84E+02	4.33E-05
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.48E+01	8.48E-07	1.23E+03	1.04E-03	7.60E+04	9.29E+01	4.94E+00	1.69E-07	1.23E+03	2.07E-04
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.13E+01	7.28E-07	7.37E+02	5.37E-04	1.19E+06	1.25E+03	4.24E+00	1.45E-07	7.37E+02	1.07E-04
	7.24E+08			4.19E+03				4.28E+00		2.10E+04		1.38E-04		8.52E-01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.28E+02	5.00E+02	4.26E+02
5.00E+01	2.14E+02	2.50E+02	2.13E+02
1.00E+03	4.28E+03	5.00E+03	4.26E+03

Monitor efficiencies from ERS-SFL-85-031
SPING VS-109 Channel 7

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m^3
Release (uCi/s) CF for TEDE = 9.40E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 9.45E+03 (Expression 5)

Isotope	U1 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	5.84E+01	2.00E-06	2.43E+01	4.86E-05	0.00E+00	0.00E+00	5.87E+00	2.01E-07	2.43E+01	4.88E-06
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.09E+02	7.13E-06	1.48E+03	1.05E-02	0.00E+00	0.00E+00	2.10E+01	7.17E-07	1.48E+03	1.06E-03
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	1.85E+04	6.33E-04	2.57E+01	1.63E-02	0.00E+00	0.00E+00	1.86E+03	6.36E-05	2.57E+01	1.64E-03
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.32E+02	4.52E-06	7.42E+03	3.35E-02	0.00E+00	0.00E+00	1.33E+01	4.54E-07	7.42E+03	3.37E-03
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	3.85E+02	1.31E-05	1.83E+04	2.40E-01	0.00E+00	0.00E+00	3.87E+01	1.32E-06	1.83E+04	2.42E-02
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.38E+00	1.15E-07	1.72E+04	1.98E-03	0.00E+00	0.00E+00	3.40E-01	1.16E-08	1.72E+04	1.99E-04
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	7.88E+02	2.69E-05	1.88E+02	5.07E-03	0.00E+00	0.00E+00	7.92E+01	2.71E-06	1.88E+02	5.09E-04
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.06E+02	2.41E-05	3.88E+02	9.37E-03	0.00E+00	0.00E+00	7.10E+01	2.42E-06	3.88E+02	9.42E-04
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	4.74E+04	1.62E-03	3.54E+02	5.72E-01	0.00E+00	0.00E+00	4.76E+03	1.63E-04	3.54E+02	5.75E-02
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.09E+04	7.14E-04	4.03E+03	2.88E+00	0.00E+00	0.00E+00	2.10E+03	7.18E-05	4.03E+03	2.89E-01
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	4.69E+03	1.60E-04	2.32E+03	3.72E-01	0.00E+00	0.00E+00	4.72E+02	1.61E-05	2.32E+03	3.74E-02
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.02E+01	3.49E-07	1.76E+03	6.14E-04	0.00E+00	0.00E+00	1.03E+00	3.51E-08	1.76E+03	6.17E-05
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.11E+01	2.43E-06	1.05E+04	2.56E-02	0.00E+00	0.00E+00	7.14E+00	2.44E-07	1.05E+04	2.57E-03
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.33E+01	7.95E-07	1.78E+02	1.42E-04	2.44E+07	6.04E+03	2.34E+00	7.99E-08	1.78E+02	1.42E-05
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.39E+01	8.18E-07	1.07E+03	8.76E-04	2.90E+05	7.38E+01	2.40E+00	8.22E-08	1.07E+03	8.81E-05
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.03E+01	1.38E-06	2.84E+02	3.91E-04	5.77E+06	2.48E+03	4.06E+00	1.39E-07	2.84E+02	3.93E-05
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	2.77E+01	9.46E-07	1.23E+03	1.16E-03	7.60E+04	2.24E+01	2.78E+00	9.51E-08	1.23E+03	1.17E-04
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.07E+01	1.05E-06	7.37E+02	7.74E-04	1.19E+06	3.89E+02	3.09E+00	1.06E-07	7.37E+02	7.78E-05
	4.01E+02			9.05E+02				4.17E+00		9.00E+03		3.23E-04		4.19E-01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.17E+02	5.00E+02	2.10E+02
5.00E+01	2.08E+02	2.50E+02	1.05E+02
1.00E+03	4.17E+03	5.00E+03	2.10E+03

Monitor efficiencies from ERS-SFL-85-031
SPING VS-109 Channel 7

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m^3
Release (uCi/s) CF for TEDE = 1.98E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.09E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	4.89E+02	1.67E-05	2.43E+01	4.07E-04	0.00E+00	0.00E+00	2.70E+02	9.23E-06	2.43E+01	2.25E-04
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.17E+03	3.99E-05	1.48E+03	5.89E-02	0.00E+00	0.00E+00	6.45E+02	2.20E-05	1.48E+03	3.25E-02
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	2.84E+03	9.71E-05	2.57E+01	2.50E-03	0.00E+00	0.00E+00	1.57E+03	5.37E-05	2.57E+01	1.38E-03
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	6.68E+02	2.28E-05	7.42E+03	1.69E-01	0.00E+00	0.00E+00	3.69E+02	1.26E-05	7.42E+03	9.36E-02
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.09E+03	7.13E-05	1.83E+04	1.30E+00	0.00E+00	0.00E+00	1.15E+03	3.94E-05	1.83E+04	7.21E-01
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	4.81E+01	1.65E-06	1.72E+04	2.82E-02	0.00E+00	0.00E+00	2.66E+01	9.09E-07	1.72E+04	1.56E-02
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.38E+03	8.14E-05	1.88E+02	1.53E-02	0.00E+00	0.00E+00	1.32E+03	4.50E-05	1.88E+02	8.46E-03
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	2.86E+03	9.76E-05	3.88E+02	3.79E-02	0.00E+00	0.00E+00	1.58E+03	5.39E-05	3.88E+02	2.09E-02
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.69E+05	5.78E-03	3.54E+02	2.04E+00	0.00E+00	0.00E+00	9.34E+04	3.19E-03	3.54E+02	1.13E+00
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	1.82E+03	6.21E-05	4.03E+03	2.50E-01	0.00E+00	0.00E+00	1.00E+03	3.43E-05	4.03E+03	1.38E-01
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.36E+04	4.64E-04	2.32E+03	1.08E+00	0.00E+00	0.00E+00	7.50E+03	2.56E-04	2.32E+03	5.95E-01
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.24E+02	4.24E-06	1.76E+03	7.44E-03	0.00E+00	0.00E+00	6.85E+01	2.34E-06	1.76E+03	4.11E-03
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.33E+02	1.48E-05	1.05E+04	1.56E-01	0.00E+00	0.00E+00	2.39E+02	8.17E-06	1.05E+04	8.61E-02
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	5.80E+00	1.98E-07	1.78E+02	3.53E-05	2.44E+07	7.17E+02	3.20E+00	1.10E-07	1.78E+02	1.95E-05
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.00E-01	6.83E-09	1.07E+03	7.32E-06	2.90E+05	2.93E-01	1.10E-01	3.77E-09	1.07E+03	4.04E-06
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	1.98E+00	6.78E-08	2.84E+02	1.93E-05	5.77E+06	5.80E+01	1.10E+00	3.75E-08	2.84E+02	1.06E-05
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.19E-01	4.06E-09	1.23E+03	4.99E-06	7.60E+04	4.58E-02	6.57E-02	2.25E-09	1.23E+03	2.76E-06
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	7.43E-01	2.54E-08	7.37E+02	1.87E-05	1.19E+06	4.47E+00	4.10E-01	1.40E-08	7.37E+02	1.03E-05
	1.54E+04			4.31E+02				5.15E+00		7.79E+02		3.73E-03		2.84E+00

TEDE	cpm	Child Thyroid	cpm
1.00E+02	5.15E+02	5.00E+02	1.42E+03
5.00E+01	2.57E+02	2.50E+02	7.11E+02
1.00E+03	5.15E+03	5.00E+03	1.42E+04

X/Q = 1.03E-04 s/m³

Monitor efficiencies from ERS-SFL-85-031 | Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01) | Release (uCi/s) CF for TEDE = 1.17E+05 (Expression 5)

SPING VS-109 Channel 9 | Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s | Release (uCi/s) CF for Child Thyroid = 5.16E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.37E+02	8.11E-06	4.99E-01	4.05E-06	0.00E+00	0.00E+00	1.04E+01	3.56E-07	4.99E-01	1.28E-07
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	5.82E+02	1.99E-05	3.03E+01	6.02E-04	0.00E+00	0.00E+00	2.56E+01	8.74E-07	3.03E+01	2.65E-05
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.34E+03	1.14E-04	1.11E+00	1.27E-04	0.00E+00	0.00E+00	1.47E+02	5.02E-06	1.11E+00	5.59E-06
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.22E+02	7.60E-06	1.52E+02	1.16E-03	0.00E+00	0.00E+00	9.78E+00	3.34E-07	1.52E+02	5.09E-06
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	9.43E+02	3.22E-05	3.75E+02	1.21E-02	0.00E+00	0.00E+00	4.14E+01	1.42E-06	3.75E+02	5.31E-04
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	1.97E-01	6.75E-09	3.52E+02	2.38E-06	0.00E+00	0.00E+00	8.68E-03	2.96E-10	3.52E+02	1.04E-07
Xe-131m	7.28E+02	1.63E-02	4.29E+01	6.98E-01	1.91E+03	6.53E-05	3.86E+00	2.52E-04	0.00E+00	0.00E+00	8.40E+01	2.87E-06	3.86E+00	1.11E-06
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.67E+03	5.70E-05	7.97E+00	4.54E-04	0.00E+00	0.00E+00	7.32E+01	2.50E-06	7.97E+00	1.99E-05
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	9.79E+04	3.35E-03	3.95E+00	1.32E-02	0.00E+00	0.00E+00	4.30E+03	1.47E-04	3.95E+00	5.81E-04
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.26E+03	1.12E-04	8.27E+01	9.23E-03	0.00E+00	0.00E+00	1.43E+02	4.90E-06	8.27E+01	4.05E-04
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.14E+03	2.44E-04	4.76E+01	1.16E-02	0.00E+00	0.00E+00	3.14E+02	1.07E-05	4.76E+01	5.10E-04
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	6.71E-01	2.29E-08	3.60E+01	8.27E-07	0.00E+00	0.00E+00	2.95E-02	1.01E-09	3.60E+01	3.63E-08
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.05E+01	7.02E-07	2.16E+02	1.52E-04	0.00E+00	0.00E+00	9.02E-01	3.08E-08	2.16E+02	6.66E-06
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	7.19E+01	2.46E-06	3.66E+00	8.99E-06	2.44E+07	1.49E+04	3.16E+00	1.08E-07	3.66E+00	3.95E-07
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.48E+01	1.19E-06	2.20E+01	2.61E-05	2.90E+05	8.58E+01	1.53E+00	5.22E-08	2.20E+01	1.15E-06
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	2.79E+01	9.54E-07	5.82E+00	5.55E-06	5.77E+06	1.37E+03	1.23E+00	4.19E-08	5.82E+00	2.44E-07
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.71E+00	5.86E-08	2.52E+01	1.48E-06	7.60E+04	1.11E+00	7.53E-02	2.57E-09	2.52E+01	6.49E-08
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	8.90E+00	3.04E-07	1.51E+01	4.60E-06	1.19E+06	9.02E+01	3.91E-01	1.34E-08	1.51E+01	2.02E-07
	4.46E+04			7.24E+02				4.89E-02		1.65E+04		1.76E-04		2.15E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.89E+00	5.00E+02	1.08E+00
5.00E+01	2.45E+00	2.50E+02	5.38E-01
1.00E+03	4.89E+01	5.00E+03	1.08E+01

X/Q = 1.03E-04 s/m³

Monitor efficiencies from ERS-SFL-85-031 | Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01) | Release (uCi/s) CF for TEDE = 1.38E+05 (Expression 5)

SPING VS-109 Channel 9 | Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s | Release (uCi/s) CF for Child Thyroid = 7.70E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	2.78E+02	9.51E-06	4.99E-01	4.75E-06	0.00E+00	0.00E+00	1.58E+01	5.39E-07	4.99E-01	2.69E-07
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	6.82E+02	2.33E-05	3.03E+01	7.05E-04	0.00E+00	0.00E+00	3.87E+01	1.32E-06	3.03E+01	4.00E-05
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	1.96E+03	6.71E-05	1.11E+00	7.47E-05	0.00E+00	0.00E+00	1.11E+02	3.80E-06	1.11E+00	4.23E-06
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.61E+02	8.93E-06	1.52E+02	1.36E-03	0.00E+00	0.00E+00	1.48E+01	5.06E-07	1.52E+02	7.71E-05
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.11E+03	3.78E-05	3.75E+02	1.42E-02	0.00E+00	0.00E+00	6.28E+01	2.14E-06	3.75E+02	8.05E-04
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.32E-01	7.92E-09	3.52E+02	2.79E-06	0.00E+00	0.00E+00	1.31E-02	4.49E-10	3.52E+02	1.68E-07
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.24E+03	7.66E-05	3.86E+00	2.96E-04	0.00E+00	0.00E+00	1.27E+02	4.34E-06	3.86E+00	1.68E-05
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.18E+00	1.96E+03	6.71E-05	7.97E+00	5.35E-04	0.00E+00	0.00E+00	1.11E+02	3.80E-06	7.97E+00	3.03E-05
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.15E+05	3.92E-03	3.95E+00	1.55E-02	0.00E+00	0.00E+00	6.51E+03	2.23E-04	3.95E+00	8.80E-04
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	3.83E+03	1.31E-04	8.27E+01	1.08E-02	0.00E+00	0.00E+00	2.17E+02	7.43E-06	8.27E+01	6.14E-04
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	8.38E+03	2.86E-04	4.76E+01	1.36E-02	0.00E+00	0.00E+00	4.75E+02	1.62E-05	4.76E+01	7.73E-04
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	7.87E-01	2.69E-08	3.60E+01	9.69E-07	0.00E+00	0.00E+00	4.46E-02	1.52E-09	3.60E+01	5.50E-08
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.41E+01	8.24E-07	2.16E+02	1.78E-04	0.00E+00	0.00E+00	1.37E+00	4.67E-08	2.16E+02	1.01E-05
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.27E+01	1.80E-06	3.66E+00	6.59E-06	2.44E+07	9.48E+03	2.99E+00	1.02E-07	3.66E+00	3.74E-07
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.08E+01	1.39E-06	2.20E+01	3.07E-05	2.90E+05	8.72E+01	2.31E+00	7.91E-08	2.20E+01	1.74E-06
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.28E+01	1.12E-06	5.82E+00	6.52E-06	5.77E+06	1.39E+03	1.86E+00	6.35E-08	5.82E+00	3.70E-07
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.01E+00	6.87E-08	2.52E+01	1.73E-06	7.60E+04	1.13E+00	1.14E-01	3.89E-09	2.52E+01	9.81E-08
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.04E+01	3.57E-07	1.51E+01	5.39E-06	1.19E+06	9.15E+01	5.92E-01	2.02E-08	1.51E+01	3.08E-07
	8.78E+05			6.27E+02				5.74E-02		1.10E+04		2.63E-04		3.25E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	5.74E+00	5.00E+02	1.63E+00
5.00E+01	2.87E+00	2.50E+02	8.13E-01
1.00E+03	5.74E+01	5.00E+03	1.63E+01

Monitor efficiencies from ERS-SFL-85-031
SPING VS-109 Channel 9

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m^3
Release (uCi/s) CF for TEDE = 6.41E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.54E+04 (Expression 5)

Isotope	U1 only LOCA RCS (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.46E+01	4.98E-07	4.99E-01	2.49E-07	0.00E+00	0.00E+00	8.06E-01	2.75E-08	4.99E-01	1.37E-08
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.02E+01	2.06E-06	3.03E+01	6.23E-05	0.00E+00	0.00E+00	3.32E+00	1.14E-07	3.03E+01	3.44E-06
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.56E+05	1.22E-02	1.11E+00	1.35E-02	0.00E+00	0.00E+00	1.97E+04	6.72E-04	1.11E+00	7.46E-04
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	7.66E+00	2.62E-07	1.52E+02	3.99E-05	0.00E+00	0.00E+00	4.23E-01	1.45E-08	1.52E+02	2.20E-06
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	6.55E+01	2.24E-06	3.75E+02	8.40E-04	0.00E+00	0.00E+00	3.62E+00	1.24E-07	3.75E+02	4.64E-05
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.18E-04	1.09E-11	3.52E+02	3.82E-09	0.00E+00	0.00E+00	1.76E-05	6.00E-13	3.52E+02	2.11E-10
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.28E+04	4.39E-04	3.86E+00	1.69E-03	0.00E+00	0.00E+00	7.09E+02	2.42E-05	3.86E+00	9.35E-05
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	1.97E+03	6.73E-05	7.97E+00	5.36E-04	0.00E+00	0.00E+00	1.09E+02	3.72E-06	7.97E+00	2.96E-05
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	2.70E+05	9.22E-03	3.95E+00	3.65E-02	0.00E+00	0.00E+00	1.49E+04	5.09E-04	3.95E+00	2.01E-03
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.32E+02	4.50E-06	8.27E+01	3.72E-04	0.00E+00	0.00E+00	7.27E+00	2.49E-07	8.27E+01	2.06E-05
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.02E+02	6.92E-06	4.76E+01	3.29E-04	0.00E+00	0.00E+00	1.12E+01	3.82E-07	4.76E+01	1.82E-05
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.29E-03	4.42E-11	3.60E+01	1.59E-09	0.00E+00	0.00E+00	7.15E-05	2.44E-12	3.60E+01	8.81E-11
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.44E-01	4.91E-09	2.16E+02	1.06E-06	0.00E+00	0.00E+00	7.94E-03	2.71E-10	2.16E+02	5.86E-08
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	5.89E+01	2.01E-06	3.66E+00	7.36E-06	2.44E+07	2.24E+03	3.25E+00	1.11E-07	3.66E+00	4.07E-07
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	3.94E+01	1.35E-06	2.20E+01	2.96E-05	2.90E+05	1.78E+01	2.18E+00	7.44E-08	2.20E+01	1.64E-06
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.50E+01	5.13E-07	5.82E+00	2.99E-06	5.77E+06	1.35E+02	8.30E-01	2.84E-08	5.82E+00	1.65E-07
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	3.93E-01	1.34E-08	2.52E+01	3.38E-07	7.60E+04	4.66E-02	2.17E-02	7.42E-10	2.52E+01	1.87E-08
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.09E+00	1.40E-07	1.51E+01	2.11E-06	1.19E+06	7.59E+00	2.26E-01	7.72E-09	1.51E+01	1.17E-07
	5.89E+01			1.33E+02				5.39E-02		2.40E+03		1.21E-03		2.98E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	5.39E+00	5.00E+02	1.49E+00
5.00E+01	2.70E+00	2.50E+02	7.45E-01
1.00E+03	5.39E+01	5.00E+03	1.49E+01

Monitor efficiencies from ERS-SFL-85-031
SPING VS-109 Channel 9

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.005)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m^3
Release (uCi/s) CF for TEDE = 2.03E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 4.04E+03 (Expression 5)

Isotope	U1 only LOCA TID (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.65E+02	9.07E-06	4.99E-01	4.53E-06	0.00E+00	0.00E+00	5.28E+01	1.80E-06	4.99E-01	9.00E-07
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	5.47E+02	1.87E-05	3.03E+01	5.66E-04	0.00E+00	0.00E+00	1.09E+02	3.72E-06	3.03E+01	1.13E-04
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.32E+01	7.92E-07	1.11E+00	8.82E-07	0.00E+00	0.00E+00	4.61E+00	1.58E-07	1.11E+00	1.75E-07
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.10E+03	3.75E-05	1.52E+02	5.71E-03	0.00E+00	0.00E+00	2.18E+02	7.45E-06	1.52E+02	1.14E-03
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.52E+03	5.20E-05	3.75E+02	1.95E-02	0.00E+00	0.00E+00	3.03E+02	1.04E-05	3.75E+02	3.89E-03
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	1.89E+03	6.47E-05	3.52E+02	2.28E-02	0.00E+00	0.00E+00	3.77E+02	1.29E-05	3.52E+02	4.53E-03
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.03E+01	1.03E-06	3.86E+00	3.99E-06	0.00E+00	0.00E+00	6.03E+00	2.06E-07	3.86E+00	7.95E-07
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.42E+02	4.84E-06	7.97E+00	3.86E-05	0.00E+00	0.00E+00	2.82E+01	9.63E-07	7.97E+00	7.67E-06
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	4.49E+03	1.53E-04	3.95E+00	6.06E-04	0.00E+00	0.00E+00	8.93E+02	3.05E-05	3.95E+00	1.21E-04
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	9.42E+02	3.22E-05	8.27E+01	2.66E-03	0.00E+00	0.00E+00	1.87E+02	6.41E-06	8.27E+01	5.30E-04
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.36E+03	4.64E-05	4.76E+01	2.21E-03	0.00E+00	0.00E+00	2.70E+02	9.23E-06	4.76E+01	4.39E-04
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.09E+03	1.40E-04	3.60E+01	5.04E-03	0.00E+00	0.00E+00	8.15E+02	2.78E-05	3.60E+01	1.00E-03
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	3.81E+03	1.30E-04	2.16E+02	2.82E-02	0.00E+00	0.00E+00	7.59E+02	2.59E-05	2.16E+02	5.60E-03
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.09E+01	3.73E-07	3.66E+00	1.36E-06	2.44E+07	1.31E+04	2.17E+00	7.42E-08	3.66E+00	2.71E-07
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.60E+01	5.46E-07	2.20E+01	1.20E-05	2.90E+05	2.28E+02	3.18E+00	1.09E-07	2.20E+01	2.39E-06
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.24E+01	7.67E-07	5.82E+00	4.46E-06	5.77E+06	6.37E+03	4.46E+00	1.53E-07	5.82E+00	8.88E-07
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.48E+01	8.48E-07	2.52E+01	2.14E-05	7.60E+04	9.29E+01	4.94E+00	1.69E-07	2.52E+01	4.25E-06
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.13E+01	7.28E-07	1.51E+01	1.10E-05	1.19E+06	1.25E+03	4.24E+00	1.45E-07	1.51E+01	2.19E-06
	7.24E+08			4.19E+03				8.74E-02		2.10E+04		1.38E-04		1.74E-02

TEDE	cpm	Child Thyroid	cpm
1.00E+02	8.74E+00	5.00E+02	8.69E+00
5.00E+01	4.37E+00	2.50E+02	4.35E+00
1.00E+03	8.74E+01	5.00E+03	8.69E+01

X/Q = 1.03E-04 s/m³

Monitor efficiencies from ERS-SFL-85-031 | Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01) | Release (uCi/s) CF for TEDE = 9.40E+04 (Expression 5)

SPING VS-109 Channel 9 | Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s | Release (uCi/s) CF for Child Thyroid = 9.45E+03 (Expression 5)

Isotope	U1 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	5.84E+01	2.00E-06	4.99E-01	9.96E-07	0.00E+00	0.00E+00	5.87E+00	2.01E-07	4.99E-01	1.00E-07
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.09E+02	7.13E-06	3.03E+01	2.16E-04	0.00E+00	0.00E+00	2.10E+01	7.17E-07	3.03E+01	2.17E-05
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	1.85E+04	6.33E-04	1.11E+00	7.05E-04	0.00E+00	0.00E+00	1.86E+03	6.36E-05	1.11E+00	7.08E-05
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.32E+02	4.52E-06	1.52E+02	6.88E-04	0.00E+00	0.00E+00	1.33E+01	4.54E-07	1.52E+02	6.92E-05
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	3.85E+02	1.31E-05	3.75E+02	4.93E-03	0.00E+00	0.00E+00	3.87E+01	1.32E-06	3.75E+02	4.96E-04
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.38E+00	1.15E-07	3.52E+02	4.06E-05	0.00E+00	0.00E+00	3.40E-01	1.16E-08	3.52E+02	4.09E-06
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	7.88E+02	2.69E-05	3.86E+00	1.04E-04	0.00E+00	0.00E+00	7.92E+01	2.71E-06	3.86E+00	1.04E-05
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.06E+02	2.41E-05	7.97E+00	1.92E-04	0.00E+00	0.00E+00	7.10E+01	2.42E-06	7.97E+00	1.93E-05
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	4.74E+04	1.62E-03	3.95E+00	6.40E-03	0.00E+00	0.00E+00	4.76E+03	1.63E-04	3.95E+00	6.43E-04
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.09E+04	7.14E-04	8.27E+01	5.91E-02	0.00E+00	0.00E+00	2.10E+03	7.18E-05	8.27E+01	5.94E-03
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	4.69E+03	1.60E-04	4.76E+01	7.63E-03	0.00E+00	0.00E+00	4.72E+02	1.61E-05	4.76E+01	7.67E-04
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.02E+01	3.49E-07	3.60E+01	1.26E-05	0.00E+00	0.00E+00	1.03E+00	3.51E-08	3.60E+01	1.27E-06
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.11E+01	2.43E-06	2.16E+02	5.25E-04	0.00E+00	0.00E+00	7.14E+00	2.44E-07	2.16E+02	5.28E-05
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.33E+01	7.96E-07	3.66E+00	2.91E-06	2.44E+07	6.04E+03	2.34E+00	7.99E-08	3.66E+00	2.92E-07
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.39E+01	8.18E-07	2.20E+01	1.80E-05	2.90E+05	7.38E+01	2.40E+00	8.22E-08	2.20E+01	1.81E-06
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.03E+01	1.38E-06	5.82E+00	8.03E-06	5.77E+06	2.48E+03	4.06E+00	1.39E-07	5.82E+00	8.07E-07
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	2.77E+01	9.46E-07	2.52E+01	2.38E-05	7.60E+04	2.24E+01	2.78E+00	9.51E-08	2.52E+01	2.40E-06
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.07E+01	1.05E-06	1.51E+01	1.59E-05	1.19E+06	3.89E+02	3.09E+00	1.06E-07	1.51E+01	1.60E-06
	4.01E+02			9.05E+02				8.06E-02		9.00E+03		3.23E-04		8.10E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	8.06E+00	5.00E+02	4.05E+00
5.00E+01	4.03E+00	2.50E+02	2.02E+00
1.00E+03	8.06E+01	5.00E+03	4.05E+01

X/Q = 1.03E-04 s/m³

Monitor efficiencies from ERS-SFL-85-031 | Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01) | Release (uCi/s) CF for TEDE = 1.98E+05 (Expression 5)

SPING VS-109 Channel 9 | Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s | Release (uCi/s) CF for Child Thyroid = 1.09E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.62E+01	2.48E-03	4.69E-01	1.16E-03	4.89E+02	1.67E-05	4.99E-01	8.34E-06	0.00E+00	0.00E+00	2.70E+02	9.23E-06	4.99E-01	4.61E-06
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.17E+03	3.99E-05	3.03E+01	1.21E-03	0.00E+00	0.00E+00	6.45E+02	2.20E-05	3.03E+01	6.66E-04
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	2.84E+03	9.71E-05	1.11E+00	1.08E-04	0.00E+00	0.00E+00	1.57E+03	5.37E-05	1.11E+00	5.97E-05
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	6.68E+02	2.28E-05	1.52E+02	3.48E-03	0.00E+00	0.00E+00	3.69E+02	1.26E-05	1.52E+02	1.92E-03
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.09E+03	7.13E-05	3.75E+02	2.68E-02	0.00E+00	0.00E+00	1.15E+03	3.94E-05	3.75E+02	1.48E-02
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	4.81E+01	1.65E-06	3.52E+02	5.79E-04	0.00E+00	0.00E+00	2.66E+01	9.09E-07	3.52E+02	3.20E-04
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.38E+03	8.14E-05	3.86E+00	3.14E-04	0.00E+00	0.00E+00	1.32E+03	4.50E-05	3.86E+00	1.74E-04
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	2.86E+03	9.76E-05	7.97E+00	7.77E-04	0.00E+00	0.00E+00	1.58E+03	5.39E-05	7.97E+00	4.30E-04
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.69E+05	5.78E-03	3.95E+00	2.28E-02	0.00E+00	0.00E+00	9.34E+04	3.19E-03	3.95E+00	1.26E-02
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	1.82E+03	6.21E-05	8.27E+01	5.14E-03	0.00E+00	0.00E+00	1.00E+03	3.43E-05	8.27E+01	2.84E-03
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.36E+04	4.64E-04	4.76E+01	2.21E-02	0.00E+00	0.00E+00	7.50E+03	2.56E-04	4.76E+01	1.22E-02
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.24E+02	4.24E-06	3.60E+01	1.53E-04	0.00E+00	0.00E+00	6.85E+01	2.34E-06	3.60E+01	8.43E-05
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.33E+02	1.48E-05	2.16E+02	3.20E-03	0.00E+00	0.00E+00	2.39E+02	8.17E-06	2.16E+02	1.77E-03
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	5.80E+00	1.98E-07	3.66E+00	7.25E-07	2.44E+07	7.17E+02	3.20E+00	1.10E-07	3.66E+00	4.01E-07
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.00E-01	6.83E-09	2.20E+01	1.50E-07	2.90E+05	2.93E-01	1.10E-01	3.77E-09	2.20E+01	8.30E-08
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	1.98E+00	6.78E-08	5.82E+00	3.95E-07	5.77E+06	6.80E+01	1.10E+00	3.75E-08	5.82E+00	2.18E-07
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.19E-01	4.06E-09	2.52E+01	1.02E-07	7.60E+04	4.58E-02	6.57E-02	2.25E-09	2.52E+01	5.66E-08
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	7.43E-01	2.54E-08	1.51E+01	3.84E-07	1.19E+06	4.47E+00	4.10E-01	1.40E-08	1.51E+01	2.12E-07
	1.54E+04			4.31E+02				8.66E-02		7.79E+02		3.73E-03		4.79E-02

TEDE	cpm	Child Thyroid	cpm
1.00E+02	8.66E+00	6.00E+02	2.39E+01
5.00E+01	4.33E+00	2.50E+02	1.20E+01
1.00E+03	8.66E+01	5.00E+03	2.39E+02

Monitor efficiencies from ERS-SFL-85-031 | Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)

VS-111 LR SA10 | Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m^3

Release (uCi/s) CF for TEDE = 1.17E+05 (Expression 5)

Release (uCi/s) CF for Child Thyroid = 5.16E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.37E+02	8.11E-08	2.69E+03	2.18E-02	0.00E+00	0.00E+00	1.04E+01	3.56E-07	2.69E+03	9.59E-04
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	5.82E+02	1.99E-05	1.63E+05	3.25E+00	0.00E+00	0.00E+00	2.56E+01	8.74E-07	1.63E+05	1.43E-01
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.34E+03	1.14E-04	2.78E+03	3.18E-01	0.00E+00	0.00E+00	1.47E+02	5.02E-06	2.78E+03	1.40E-02
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.22E+02	7.60E-06	8.21E+05	6.24E+00	0.00E+00	0.00E+00	9.78E+00	3.34E-07	8.21E+05	2.74E-01
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	9.43E+02	3.22E-05	2.02E+06	8.52E+01	0.00E+00	0.00E+00	4.14E+01	1.42E-06	2.02E+06	2.86E+00
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	1.97E-01	6.75E-09	1.90E+06	1.28E-02	0.00E+00	0.00E+00	8.68E-03	2.96E-10	1.90E+06	5.63E-04
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	1.91E+03	6.53E-05	2.08E+04	1.36E+00	0.00E+00	0.00E+00	8.40E+01	2.87E-06	2.08E+04	5.98E-02
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.67E+03	5.70E-05	4.30E+04	2.45E+00	0.00E+00	0.00E+00	7.32E+01	2.50E-06	4.30E+04	1.08E-01
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	9.79E+04	3.35E-03	3.45E+04	1.15E+02	0.00E+00	0.00E+00	4.30E+03	1.47E-04	3.45E+04	5.07E+00
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.26E+03	1.12E-04	4.46E+05	4.98E+01	0.00E+00	0.00E+00	1.43E+02	4.90E-06	4.46E+05	2.19E+00
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.14E+03	2.44E-04	2.57E+05	6.26E+01	0.00E+00	0.00E+00	3.14E+02	1.07E-05	2.57E+05	2.75E+00
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	6.71E-01	2.29E-08	1.94E+05	4.46E-03	0.00E+00	0.00E+00	2.95E-02	1.01E-09	1.94E+05	1.96E-04
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.05E+01	7.02E-07	1.17E+06	8.18E-01	0.00E+00	0.00E+00	9.02E-01	3.08E-08	1.17E+06	3.60E-02
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	7.19E+01	2.46E-06	1.97E+04	4.85E-02	2.44E+07	1.49E+04	3.16E+00	1.08E-07	1.97E+04	2.13E-03
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.48E+01	1.19E-06	1.19E+05	1.41E-01	2.90E+05	8.58E+01	1.53E+00	5.22E-08	1.19E+05	6.19E-03
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	2.79E+01	9.54E-07	3.14E+04	3.00E-02	5.77E+06	1.37E+03	1.23E+00	4.19E-08	3.14E+04	1.32E-03
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.71E+00	5.86E-08	1.36E+05	7.97E-03	7.60E+04	1.11E+00	7.53E-02	2.57E-09	1.36E+05	3.50E-04
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	8.90E+00	3.04E-07	8.16E+04	2.46E-02	1.19E+06	9.02E+01	3.91E-01	1.34E-08	8.16E+04	1.09E-03
	4.46E+04			7.24E+02				3.08E+02		1.65E+04		1.76E-04		1.35E+01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	3.08E+04	5.00E+02	6.76E+03
5.00E+01	1.54E+04	2.50E+02	3.38E+03
1.00E+03	3.08E+05	5.00E+03	6.76E+04

Monitor efficiencies from ERS-SFL-85-031 | Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)

VS-111 LR SA10 | Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m^3

Release (uCi/s) CF for TEDE = 1.36E+05 (Expression 5)

Release (uCi/s) CF for Child Thyroid = 7.70E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	2.78E+02	9.51E-08	2.69E+03	2.56E-02	0.00E+00	0.00E+00	1.58E+01	5.39E-07	2.69E+03	1.45E-03
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	6.82E+02	2.33E-05	1.63E+05	3.80E+00	0.00E+00	0.00E+00	3.87E+01	1.32E-06	1.63E+05	2.16E-01
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	1.96E+03	6.71E-05	2.78E+03	1.86E-01	0.00E+00	0.00E+00	1.11E+02	3.80E-06	2.78E+03	1.08E-02
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.61E+02	8.93E-06	8.21E+05	7.33E+00	0.00E+00	0.00E+00	1.48E+01	5.06E-07	8.21E+05	4.16E-01
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.11E+03	3.78E-05	2.02E+06	7.66E+01	0.00E+00	0.00E+00	6.28E+01	2.14E-06	2.02E+06	4.34E+00
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.32E-01	7.92E-09	1.90E+06	1.51E-02	0.00E+00	0.00E+00	1.31E-02	4.49E-10	1.90E+06	8.54E-04
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.24E+03	7.66E-05	2.08E+04	1.59E+00	0.00E+00	0.00E+00	1.27E+02	4.34E-06	2.08E+04	9.04E-02
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	1.96E+03	6.71E-05	4.30E+04	2.88E+00	0.00E+00	0.00E+00	1.11E+02	3.80E-06	4.30E+04	1.64E-01
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.15E+05	3.92E-03	3.45E+04	1.35E+02	0.00E+00	0.00E+00	6.51E+03	2.23E-04	3.45E+04	7.68E+00
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	3.83E+03	1.31E-04	4.46E+05	5.84E+01	0.00E+00	0.00E+00	2.17E+02	7.43E-06	4.46E+05	3.31E+00
Xe-135	6.42E+04	6.17E-02	1.25E+03	7.72E+01	8.38E+03	2.86E-04	2.57E+05	7.35E+01	0.00E+00	0.00E+00	4.75E+02	1.62E-05	2.57E+05	4.17E+00
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	7.87E-01	2.69E-08	1.94E+05	5.23E-03	0.00E+00	0.00E+00	4.46E-02	1.52E-09	1.94E+05	2.96E-04
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.41E+01	8.24E-07	1.17E+06	9.61E-01	0.00E+00	0.00E+00	1.37E+00	4.67E-08	1.17E+06	5.45E-02
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	6.27E+01	1.80E-06	1.97E+04	3.56E-02	2.44E+07	9.48E+03	2.99E+00	1.02E-07	1.97E+04	2.02E-03
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.08E+01	1.39E-06	1.19E+05	1.66E-01	2.90E+05	8.72E+01	2.31E+00	7.91E-08	1.19E+05	9.39E-03
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.28E+01	1.12E-06	3.14E+04	3.52E-02	5.77E+06	1.39E+03	1.86E+00	6.35E-08	3.14E+04	2.00E-03
I-134	1.30E+01	1.48E-05	2.69E+04	3.96E-01	2.01E+00	6.87E-08	1.36E+05	9.34E-03	7.60E+04	1.13E+00	1.14E-01	3.89E-09	1.36E+05	5.30E-04
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.04E+01	3.57E-07	8.16E+04	2.91E-02	1.19E+06	9.15E+01	5.92E-01	2.02E-08	8.16E+04	1.65E-03
	8.78E+05			6.27E+02				3.61E+02		1.10E+04		2.63E-04		2.05E+01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	3.61E+04	5.00E+02	1.02E+04
5.00E+01	1.81E+04	2.50E+02	5.12E+03
1.00E+03	3.61E+05	5.00E+03	1.02E+05

Monitor efficiencies from ERS-SFL-85-031
VS-111 LR SA10

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m³
Release (uCi/s) CF for TEDE = 6.41E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.54E+04 (Expression 5)

Isotope	U1 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.46E+01	4.98E-07	2.69E+03	1.34E-03	0.00E+00	0.00E+00	8.06E-01	2.75E-08	2.69E+03	7.41E-05
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.02E+01	2.06E-06	1.63E+05	3.36E-01	0.00E+00	0.00E+00	3.32E+00	1.14E-07	1.63E+05	1.86E-02
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.56E+05	1.22E-02	2.78E+03	3.38E+01	0.00E+00	0.00E+00	1.97E+04	6.72E-04	2.78E+03	1.87E+00
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	7.66E+00	2.62E-07	8.21E+05	2.15E-01	0.00E+00	0.00E+00	4.23E-01	1.45E-08	8.21E+05	1.19E-02
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	6.55E+01	2.24E-06	2.02E+06	4.53E+00	0.00E+00	0.00E+00	3.62E+00	1.24E-07	2.02E+06	2.50E-01
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.18E-04	1.09E-11	1.90E+06	2.06E-05	0.00E+00	0.00E+00	1.76E-05	6.00E-13	1.90E+06	1.14E-06
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.28E+04	4.39E-04	2.08E+04	9.14E+00	0.00E+00	0.00E+00	7.09E+02	2.42E-05	2.08E+04	5.05E-01
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.56E-01	1.97E+03	6.73E-05	4.30E+04	2.89E+00	0.00E+00	0.00E+00	1.09E+02	3.72E-06	4.30E+04	1.60E-01
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	2.70E+05	9.22E-03	3.45E+04	3.18E+02	0.00E+00	0.00E+00	1.49E+04	5.09E-04	3.45E+04	1.76E+01
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.32E+02	4.50E-06	4.46E+05	2.01E+00	0.00E+00	0.00E+00	7.27E+00	2.49E-07	4.46E+05	1.11E-01
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.02E+02	6.92E-06	2.57E+05	1.78E+00	0.00E+00	0.00E+00	1.12E+01	3.82E-07	2.57E+05	9.81E-02
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.29E-03	4.42E-11	1.94E+05	8.60E-06	0.00E+00	0.00E+00	7.15E-05	2.44E-12	1.94E+05	4.75E-07
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.44E-01	4.91E-09	1.17E+06	5.72E-03	0.00E+00	0.00E+00	7.94E-03	2.71E-10	1.17E+06	3.16E-04
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	5.89E+01	2.01E-06	1.97E+04	3.97E-02	2.44E+07	2.24E+03	3.25E+00	1.11E-07	1.97E+04	2.19E-03
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	3.94E+01	1.35E-06	1.19E+05	1.60E-01	2.90E+05	1.78E+01	2.18E+00	7.44E-08	1.19E+05	8.83E-03
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.50E+01	5.13E-07	3.14E+04	1.61E-02	5.77E+06	1.35E+02	8.30E-01	2.84E-08	3.14E+04	8.91E-04
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	3.93E-01	1.34E-08	1.36E+05	1.83E-03	7.60E+04	4.66E-02	2.17E-02	7.42E-10	1.36E+05	1.01E-04
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.09E+00	1.40E-07	8.16E+04	1.14E-02	1.19E+06	7.59E+00	2.26E-01	7.72E-09	8.16E+04	6.30E-04
	5.89E+01			1.33E+02				3.73E+02		2.40E+03		1.21E-03		2.06E+01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	3.73E+04	5.00E+02	1.03E+04
5.00E+01	1.87E+04	2.50E+02	5.15E+03
1.00E+03	3.73E+05	5.00E+03	1.03E+05

Monitor efficiencies from ERS-SFL-85-031
VS-111 LR SA10

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.005)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m³
Release (uCi/s) CF for TEDE = 2.03E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 4.04E+03 (Expression 5)

Isotope	U1 only LOCA TID (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.65E+02	9.07E-06	2.69E+03	2.44E-02	0.00E+00	0.00E+00	5.28E+01	1.80E-06	2.69E+03	4.86E-03
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	5.47E+02	1.87E-05	1.63E+05	3.05E+00	0.00E+00	0.00E+00	1.09E+02	3.72E-06	1.63E+05	6.07E-01
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.32E+01	7.92E-07	2.78E+03	2.20E-03	0.00E+00	0.00E+00	4.61E+00	1.58E-07	2.78E+03	4.38E-04
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.10E+03	3.75E-05	8.21E+05	3.08E+01	0.00E+00	0.00E+00	2.18E+02	7.45E-06	8.21E+05	6.12E+00
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.52E+03	5.20E-05	2.02E+06	1.05E+02	0.00E+00	0.00E+00	3.03E+02	1.04E-05	2.02E+06	2.10E+01
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	1.89E+03	6.47E-05	1.90E+06	1.23E+02	0.00E+00	0.00E+00	3.77E+02	1.29E-05	1.90E+06	2.44E+01
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.03E+01	1.03E-06	2.08E+04	2.15E-02	0.00E+00	0.00E+00	6.03E+00	2.06E-07	2.08E+04	4.29E-03
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.42E+02	4.84E-06	4.30E+04	2.08E-01	0.00E+00	0.00E+00	2.82E+01	9.63E-07	4.30E+04	4.14E-02
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	4.49E+03	1.53E-04	3.45E+04	5.29E+00	0.00E+00	0.00E+00	8.93E+02	3.05E-05	3.45E+04	1.05E+00
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	9.42E+02	3.22E-05	4.46E+05	1.44E+01	0.00E+00	0.00E+00	1.87E+02	6.41E-06	4.46E+05	2.86E+00
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.36E+03	4.64E-05	2.57E+05	1.19E+01	0.00E+00	0.00E+00	2.70E+02	9.23E-06	2.57E+05	2.37E+00
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.09E+03	1.40E-04	1.94E+05	2.72E+01	0.00E+00	0.00E+00	8.15E+02	2.78E-05	1.94E+05	5.41E+00
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	3.81E+03	1.30E-04	1.17E+06	1.52E+02	0.00E+00	0.00E+00	7.59E+02	2.59E-05	1.17E+06	3.02E+01
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.09E+01	3.73E-07	1.97E+04	7.36E-03	2.44E+07	1.31E+04	2.17E+00	7.42E-08	1.97E+04	1.46E-03
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.60E+01	5.46E-07	1.19E+05	6.48E-02	2.90E+05	2.28E+02	3.18E+00	1.09E-07	1.19E+05	1.29E-02
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.24E+01	7.67E-07	3.14E+04	2.41E-02	5.77E+06	6.37E+03	4.46E+00	1.53E-07	3.14E+04	4.79E-03
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.48E+01	8.48E-07	1.36E+05	1.15E-01	7.60E+04	9.29E+01	4.94E+00	1.69E-07	1.36E+05	2.29E-02
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.13E+01	7.28E-07	8.16E+04	5.94E-02	1.19E+06	1.25E+03	4.24E+00	1.45E-07	8.16E+04	1.18E-02
	7.24E+08			4.19E+03				4.73E+02		2.10E+04		1.38E-04		9.42E+01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.73E+04	5.00E+02	4.71E+04
5.00E+01	2.37E+04	2.50E+02	2.35E+04
1.00E+03	4.73E+05	5.00E+03	4.71E+05

X/Q = 1.03E-04 s/m^3

Monitor efficiencies from ERS-SFL-85-031 — Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01) — Release (uCi/s) CF for TEDE = 9.40E+04 (Expression 5)

VS-111 LR SA10 — Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s — Release (uCi/s) CF for Child Thyroid = 9.45E+03 (Expression 5)

Isotope	U1 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	5.84E+01	2.00E-06	2.69E+03	5.37E-03	0.00E+00	0.00E+00	5.87E+00	2.01E-07	2.69E+03	5.40E-04
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.09E+02	7.13E-06	1.63E+05	1.16E+00	0.00E+00	0.00E+00	2.10E+01	7.17E-07	1.63E+05	1.17E-01
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	1.86E+04	6.33E-04	2.78E+03	1.76E+00	0.00E+00	0.00E+00	1.86E+03	6.36E-05	2.78E+03	1.77E-01
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.32E+02	4.52E-06	8.21E+05	3.71E+00	0.00E+00	0.00E+00	1.33E+01	4.54E-07	8.21E+05	3.73E-01
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	3.85E+02	1.31E-05	2.02E+06	2.66E+01	0.00E+00	0.00E+00	3.87E+01	1.32E-06	2.02E+06	2.67E+00
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.38E+00	1.15E-07	1.90E+06	2.19E-01	0.00E+00	0.00E+00	3.40E-01	1.16E-08	1.90E+06	2.20E-02
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	7.88E+02	2.69E-05	2.08E+04	5.61E-01	0.00E+00	0.00E+00	7.92E+01	2.71E-06	2.08E+04	5.64E-02
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.06E+02	2.41E-05	4.30E+04	1.04E+00	0.00E+00	0.00E+00	7.10E+01	2.42E-06	4.30E+04	1.04E-01
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	4.74E+04	1.62E-03	3.45E+04	5.59E+01	0.00E+00	0.00E+00	4.76E+03	1.63E-04	3.45E+04	5.61E+00
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.09E+04	7.14E-04	4.46E+05	3.19E+02	0.00E+00	0.00E+00	2.10E+03	7.18E-05	4.46E+05	3.20E+01
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	4.69E+03	1.60E-04	2.57E+05	4.12E+01	0.00E+00	0.00E+00	4.72E+02	1.61E-05	2.57E+05	4.14E+00
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.02E+01	3.49E-07	1.94E+05	6.79E-02	0.00E+00	0.00E+00	1.03E+00	3.51E-08	1.94E+05	6.83E-03
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.11E+01	2.43E-06	1.17E+06	2.83E+00	0.00E+00	0.00E+00	7.14E+00	2.44E-07	1.17E+06	2.85E-01
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.33E+01	7.95E-07	1.97E+04	1.57E-02	2.44E+07	6.04E+03	2.34E+00	7.99E-08	1.97E+04	1.58E-03
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.39E+01	8.18E-07	1.19E+05	9.70E-02	2.90E+05	7.38E+01	2.40E+00	8.22E-08	1.19E+05	9.75E-03
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.03E+01	1.38E-06	3.14E+04	4.33E-02	5.77E+06	2.48E+03	4.06E+00	1.39E-07	3.14E+04	4.35E-03
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	2.77E+01	9.46E-07	1.36E+05	1.29E-01	7.60E+04	2.24E+01	2.78E+00	9.51E-08	1.36E+05	1.29E-02
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.07E+01	1.05E-06	8.16E+04	8.56E-02	1.19E+06	3.89E+02	3.09E+00	1.06E-07	8.16E+04	8.61E-03
	4.01E+02			9.05E+02				4.54E+02		9.00E+03		3.23E-04		4.56E+01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.54E+04	5.00E+02	2.28E+04
5.00E+01	2.27E+04	2.50E+02	1.14E+04
1.00E+03	4.54E+05	5.00E+03	2.28E+05

X/Q = 1.03E-04 s/m^3

Monitor efficiencies from ERS-SFL-85-031 — Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01) — Release (uCi/s) CF for TEDE = 1.98E+05 (Expression 5)

VS-111 LR SA10 — Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s — Release (uCi/s) CF for Child Thyroid = 1.09E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	4.89E+02	1.67E-05	2.69E+03	4.50E-02	0.00E+00	0.00E+00	2.70E+02	9.23E-06	2.69E+03	2.49E-02
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.17E+03	3.99E-05	1.63E+05	6.52E+00	0.00E+00	0.00E+00	6.45E+02	2.20E-05	1.63E+05	3.60E+00
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	2.84E+03	9.71E-05	2.78E+03	2.70E-01	0.00E+00	0.00E+00	1.57E+03	5.37E-05	2.78E+03	1.49E-01
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	6.68E+02	2.28E-05	8.21E+05	1.88E+01	0.00E+00	0.00E+00	3.69E+02	1.26E-05	8.21E+05	1.04E+01
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.09E+03	7.13E-05	2.02E+06	1.44E+02	0.00E+00	0.00E+00	1.15E+03	3.94E-05	2.02E+06	7.98E+01
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	4.81E+01	1.65E-06	1.90E+06	3.13E+00	0.00E+00	0.00E+00	2.66E+01	9.09E-07	1.90E+06	1.73E+00
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.38E+03	8.14E-05	2.08E+04	1.69E+00	0.00E+00	0.00E+00	1.32E+03	4.50E-05	2.08E+04	9.36E-01
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	2.86E+03	9.76E-05	4.30E+04	4.19E+00	0.00E+00	0.00E+00	1.58E+03	5.39E-05	4.30E+04	2.32E+00
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.69E+05	5.78E-03	3.45E+04	1.99E+02	0.00E+00	0.00E+00	9.34E+04	3.19E-03	3.45E+04	1.10E+02
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	1.82E+03	6.21E-05	4.46E+05	2.77E+01	0.00E+00	0.00E+00	1.00E+03	3.43E-05	4.46E+05	1.53E+01
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.36E+04	4.64E-04	2.57E+05	1.19E+02	0.00E+00	0.00E+00	7.50E+03	2.56E-04	2.57E+05	6.58E+01
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.24E+02	4.24E-06	1.94E+05	8.23E-01	0.00E+00	0.00E+00	6.85E+01	2.34E-06	1.94E+05	4.55E-01
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.33E+02	1.48E-05	1.17E+06	1.72E+01	0.00E+00	0.00E+00	2.39E+02	8.17E-06	1.17E+06	9.53E+00
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	5.80E+00	1.98E-07	1.97E+04	3.91E-03	2.44E+07	7.17E+02	3.20E+00	1.10E-07	1.97E+04	2.16E-03
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.00E-01	6.83E-09	1.19E+05	8.10E-04	2.90E+05	2.93E-01	1.10E-01	3.77E-09	1.19E+05	4.48E-04
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	1.98E+00	6.78E-08	3.14E+04	2.13E-03	5.77E+06	5.80E+01	1.10E+00	3.75E-08	3.14E+04	1.18E-03
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.19E-01	4.06E-09	1.36E+05	5.53E-04	7.60E+04	4.58E-02	6.57E-02	2.25E-09	1.36E+05	3.05E-04
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	7.43E-01	2.54E-08	8.16E+04	2.07E-03	1.19E+06	4.47E+00	4.10E-01	1.40E-08	8.16E+04	1.14E-03
	1.54E+04			4.31E+02				5.43E+02		7.79E+02		3.73E-03		3.00E+02

TEDE	cpm	Child Thyroid	cpm
1.00E+02	5.43E+04	5.00E+02	1.50E+05
5.00E+01	2.72E+04	2.50E+02	7.50E+04
1.00E+03	5.43E+05	5.00E+03	1.50E+06

Monitor efficiencies from ERS-SFL-85-031 — Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
VS-111 HR SA9 — Release Flow Rate = 6.20E+04 cfm — 2.93E+07 cc/s
X/Q = 1.03E-04 s/m³
Release (uCi/s) CF for TEDE = 1.17E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 5.16E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.37E+02	8.11E-06	3.58E-01	2.90E-06	0.00E+00	0.00E+00	1.04E+01	3.56E-07	3.58E-01	1.27E-07
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	5.82E+02	1.99E-05	2.17E+01	4.31E-04	0.00E+00	0.00E+00	2.56E+01	8.74E-07	2.17E+01	1.89E-05
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.34E+03	1.14E-04	7.98E-01	9.11E-05	0.00E+00	0.00E+00	1.47E+02	5.02E-06	7.98E-01	4.00E-06
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.22E+02	7.60E-06	1.09E+02	8.29E-04	0.00E+00	0.00E+00	9.78E+00	3.34E-07	1.09E+02	3.64E-05
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	9.43E+02	3.22E-05	2.69E+02	8.66E-03	0.00E+00	0.00E+00	4.14E+01	1.42E-06	2.69E+02	3.80E-04
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	1.97E-01	6.75E-09	2.52E+02	1.70E-06	0.00E+00	0.00E+00	8.68E-03	2.96E-10	2.52E+02	7.48E-08
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	1.91E+03	6.53E-05	2.76E+00	1.81E-04	0.00E+00	0.00E+00	8.40E+01	2.87E-06	2.76E+00	7.93E-06
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.67E+03	5.70E-05	5.71E+00	3.25E-04	0.00E+00	0.00E+00	7.32E+01	2.50E-06	5.71E+00	1.43E-05
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	9.79E+04	3.35E-03	2.83E+00	9.48E-03	0.00E+00	0.00E+00	4.30E+03	1.47E-04	2.83E+00	4.16E-04
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.26E+03	1.12E-04	5.92E+01	6.61E-03	0.00E+00	0.00E+00	1.43E+02	4.90E-06	5.92E+01	2.90E-04
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.14E+03	2.44E-04	3.41E+01	8.31E-03	0.00E+00	0.00E+00	3.14E+02	1.07E-05	3.41E+01	3.65E-04
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	6.71E-01	2.29E-08	2.58E+01	5.92E-07	0.00E+00	0.00E+00	2.95E-02	1.01E-09	2.58E+01	2.60E-08
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.05E+01	7.02E-07	1.55E+02	1.09E-04	0.00E+00	0.00E+00	9.02E-01	3.08E-08	1.55E+02	4.77E-06
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	7.19E+01	2.46E-06	2.62E+00	6.44E-06	2.44E+07	1.49E+04	3.16E+00	1.08E-07	2.62E+00	2.83E-07
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.48E+01	1.19E-06	1.58E+01	1.87E-05	2.90E+05	8.58E+01	1.53E+00	5.22E-08	1.58E+01	8.22E-07
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	2.79E+01	9.54E-07	4.17E+00	3.98E-06	5.77E+06	1.37E+03	1.23E+00	4.19E-08	4.17E+00	1.75E-07
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.71E+00	5.86E-08	1.81E+01	1.06E-06	7.60E+04	1.11E+00	7.53E-02	2.57E-09	1.81E+01	4.65E-08
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	8.90E+00	3.04E-07	1.08E+01	3.29E-06	1.19E+06	9.02E+01	3.91E-01	1.34E-08	1.08E+01	1.45E-07
	4.46E+04			7.24E+02				3.51E-02		1.65E+04		1.76E-04		1.54E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	3.51E+00	5.00E+02	7.70E-01
5.00E+01	1.75E+00	2.50E+02	3.85E-01
1.00E+03	3.51E+01	5.00E+03	7.70E+00

Monitor efficiencies from ERS-SFL-85-031 — Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
VS-111 HR SA9 — Release Flow Rate = 6.20E+04 cfm — 2.93E+07 cc/s
X/Q = 1.03E-04 s/m³
Release (uCi/s) CF for TEDE = 1.36E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 7.70E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	2.78E+02	9.51E-06	3.58E-01	3.40E-06	0.00E+00	0.00E+00	1.58E+01	5.39E-07	3.58E-01	1.93E-07
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	6.82E+02	2.33E-05	2.17E+01	5.05E-04	0.00E+00	0.00E+00	3.87E+01	1.32E-06	2.17E+01	2.87E-05
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	1.96E+03	6.71E-05	7.98E-01	5.35E-05	0.00E+00	0.00E+00	1.11E+02	3.80E-06	7.98E-01	3.03E-06
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.61E+02	8.93E-06	1.09E+02	9.74E-04	0.00E+00	0.00E+00	1.48E+01	5.06E-07	1.09E+02	5.52E-05
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.11E+03	3.78E-05	2.69E+02	1.02E-02	0.00E+00	0.00E+00	6.28E+01	2.14E-06	2.69E+02	5.77E-04
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.32E-01	7.92E-09	2.52E+02	2.00E-06	0.00E+00	0.00E+00	1.31E-02	4.49E-10	2.52E+02	1.13E-07
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.24E+03	7.66E-05	2.76E+00	2.12E-04	0.00E+00	0.00E+00	1.27E+02	4.34E-06	2.76E+00	1.20E-05
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	1.96E+03	6.71E-05	5.71E+00	3.83E-04	0.00E+00	0.00E+00	1.11E+02	3.80E-06	5.71E+00	2.17E-05
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.15E+05	3.92E-03	2.83E+00	1.11E-02	0.00E+00	0.00E+00	6.51E+03	2.23E-04	2.83E+00	6.30E-04
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	3.83E+03	1.31E-04	5.92E+01	7.76E-03	0.00E+00	0.00E+00	2.17E+02	7.43E-06	5.92E+01	4.40E-04
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	8.38E+03	2.86E-04	3.41E+01	9.76E-03	0.00E+00	0.00E+00	4.75E+02	1.62E-05	3.41E+01	5.54E-04
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	7.87E-01	2.69E-08	2.58E+01	6.94E-07	0.00E+00	0.00E+00	4.46E-02	1.52E-09	2.58E+01	3.94E-08
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.41E+01	8.24E-07	1.55E+02	1.28E-04	0.00E+00	0.00E+00	1.37E+00	4.67E-08	1.55E+02	7.23E-06
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	6.27E+01	1.80E-06	2.62E+00	4.72E-06	2.44E+07	9.48E+03	2.99E+00	1.02E-07	2.62E+00	2.68E-07
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.08E+01	1.39E-06	1.58E+01	2.20E-05	2.90E+05	8.72E+01	2.31E+00	7.91E-08	1.58E+01	1.25E-06
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.28E+01	1.12E-06	4.17E+00	4.67E-06	5.77E+06	1.39E+03	1.86E+00	6.35E-08	4.17E+00	2.65E-07
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.01E+00	6.87E-08	1.81E+01	1.24E-06	7.60E+04	1.13E+00	1.14E-01	3.89E-09	1.81E+01	7.03E-08
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.04E+01	3.57E-07	1.08E+01	3.86E-06	1.19E+06	9.15E+01	5.92E-01	2.02E-08	1.08E+01	2.19E-07
	8.78E+05			6.27E+02				4.11E-02		1.10E+04		2.63E-04		2.33E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.11E+00	5.00E+02	1.17E+00
5.00E+01	2.05E+00	2.50E+02	5.83E-01
1.00E+03	4.11E+01	5.00E+03	1.17E+01

Monitor efficiencies from ERS-SFL-85-031
VS-111 HR SA9

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m³
Release (uCi/s) CF for TEDE = 6.41E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.54E+04 (Expression 5)

Isotope	U1 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.46E+01	4.98E-07	3.58E-01	1.78E-07	0.00E+00	0.00E+00	8.06E-01	2.75E-08	3.58E-01	9.84E-09
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.02E+01	2.06E-06	2.17E+01	4.46E-05	0.00E+00	0.00E+00	3.32E+00	1.14E-07	2.17E+01	2.46E-06
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.56E+05	1.22E-02	7.98E-01	9.70E-03	0.00E+00	0.00E+00	1.97E+04	6.72E-04	7.98E-01	5.36E-04
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	7.66E+00	2.62E-07	1.09E+02	2.86E-05	0.00E+00	0.00E+00	4.23E-01	1.45E-08	1.09E+02	1.58E-06
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	6.55E+01	2.24E-06	2.69E+02	6.02E-04	0.00E+00	0.00E+00	3.62E+00	1.24E-07	2.69E+02	3.32E-05
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.18E-04	1.09E-11	2.52E+02	2.74E-09	0.00E+00	0.00E+00	1.76E-05	6.00E-13	2.52E+02	1.51E-10
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.28E+04	4.39E-04	2.76E+00	1.21E-03	0.00E+00	0.00E+00	7.09E+02	2.42E-05	2.76E+00	6.70E-05
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	1.97E+03	6.73E-05	5.71E+00	3.84E-04	0.00E+00	0.00E+00	1.09E+02	3.72E-06	5.71E+00	2.12E-05
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	2.70E+05	9.22E-03	2.83E+00	2.61E-02	0.00E+00	0.00E+00	1.49E+04	5.09E-04	2.83E+00	1.44E-03
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.32E+02	4.50E-06	5.92E+01	2.66E-04	0.00E+00	0.00E+00	7.27E+00	2.49E-07	5.92E+01	1.47E-05
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.02E+02	6.92E-06	3.41E+01	2.36E-04	0.00E+00	0.00E+00	1.12E+01	3.82E-07	3.41E+01	1.30E-05
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.29E-03	4.42E-11	2.58E+01	1.14E-09	0.00E+00	0.00E+00	7.15E-05	2.44E-12	2.58E+01	6.31E-11
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.44E-01	4.91E-09	1.55E+02	7.60E-07	0.00E+00	0.00E+00	7.94E-03	2.71E-10	1.55E+02	4.20E-08
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	5.89E+01	2.01E-06	2.62E+00	5.27E-06	2.44E+07	2.24E+03	3.25E+00	1.11E-07	2.62E+00	2.91E-07
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	3.94E+01	1.35E-06	1.58E+01	2.12E-05	2.90E+05	1.78E+01	2.18E+00	7.44E-08	1.58E+01	1.17E-06
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.50E+01	5.13E-07	4.17E+00	2.14E-06	5.77E+06	1.35E+02	8.30E-01	2.84E-08	4.17E+00	1.18E-07
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	3.93E-01	1.34E-08	1.81E+01	2.42E-07	7.60E+04	4.66E-02	2.17E-02	7.42E-10	1.81E+01	1.34E-08
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.09E+00	1.40E-07	1.08E+01	1.51E-06	1.19E+06	7.59E+00	2.26E-01	7.72E-09	1.08E+01	8.37E-08
	5.89E+01			1.33E+02				3.86E-02		2.40E+03		1.21E-03		2.13E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	3.86E+00	5.00E+02	1.07E+00
5.00E+01	1.93E+00	2.50E+02	5.33E-01
1.00E+03	3.86E+01	5.00E+03	1.07E+01

Monitor efficiencies from ERS-SFL-85-031
VS-111 HR SA9

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.005)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m³
Release (uCi/s) CF for TEDE = 2.03E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 4.04E+03 (Expression 5)

Isotope	U1 only LOCA TID (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.65E+02	9.07E-06	3.58E-01	3.24E-06	0.00E+00	0.00E+00	5.28E+01	1.80E-06	3.58E-01	6.45E-07
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	5.47E+02	1.87E-05	2.17E+01	4.05E-04	0.00E+00	0.00E+00	1.09E+02	3.72E-06	2.17E+01	8.06E-05
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.32E+01	7.92E-07	7.98E-01	6.32E-07	0.00E+00	0.00E+00	4.61E+00	1.58E-07	7.98E-01	1.26E-07
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.10E+03	3.75E-05	1.09E+02	4.09E-03	0.00E+00	0.00E+00	2.18E+02	7.45E-06	1.09E+02	8.13E-04
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.52E+03	5.20E-05	2.69E+02	1.40E-02	0.00E+00	0.00E+00	3.03E+02	1.04E-05	2.69E+02	2.78E-03
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	1.89E+03	6.47E-05	2.52E+02	1.63E-02	0.00E+00	0.00E+00	3.77E+02	1.29E-05	2.52E+02	3.25E-03
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.03E+01	1.03E-06	2.76E+00	2.86E-06	0.00E+00	0.00E+00	6.03E+00	2.06E-07	2.76E+00	5.69E-07
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.42E+02	4.84E-06	5.71E+00	2.76E-05	0.00E+00	0.00E+00	2.82E+01	9.63E-07	5.71E+00	5.49E-06
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	4.49E+03	1.53E-04	2.83E+00	4.34E-04	0.00E+00	0.00E+00	8.93E+02	3.05E-05	2.83E+00	8.64E-05
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	9.42E+02	3.22E-05	5.92E+01	1.91E-03	0.00E+00	0.00E+00	1.87E+02	6.41E-06	5.92E+01	3.79E-04
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.36E+03	4.64E-05	3.41E+01	1.58E-03	0.00E+00	0.00E+00	2.70E+02	9.23E-06	3.41E+01	3.15E-04
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.09E+03	1.40E-04	2.58E+01	3.61E-03	0.00E+00	0.00E+00	8.15E+02	2.78E-05	2.58E+01	7.18E-04
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	3.81E+03	1.30E-04	1.55E+02	2.02E-02	0.00E+00	0.00E+00	7.59E+02	2.59E-05	1.55E+02	4.01E-03
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.09E+01	3.73E-07	2.62E+00	9.77E-07	2.44E+07	1.31E+04	2.17E+00	7.42E-08	2.62E+00	1.94E-07
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.60E+01	5.46E-07	1.58E+01	8.60E-06	2.90E+05	2.28E+02	3.18E+00	1.09E-07	1.58E+01	1.71E-06
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.24E+01	7.67E-07	4.17E+00	3.20E-06	5.77E+06	6.37E+03	4.46E+00	1.53E-07	4.17E+00	6.36E-07
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.48E+01	8.48E-07	1.81E+01	1.53E-05	7.60E+04	9.29E+01	4.94E+00	1.69E-07	1.81E+01	3.05E-06
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.13E+01	7.28E-07	1.08E+01	7.89E-06	1.19E+06	1.25E+03	4.24E+00	1.45E-07	1.08E+01	1.57E-06
	7.24E+08			4.19E+03				6.26E-02		2.10E+04		1.38E-04		1.24E-02

TEDE	cpm	Child Thyroid	cpm
1.00E+02	6.26E+00	5.00E+02	6.22E+00
5.00E+01	3.13E+00	2.50E+02	3.11E+00
1.00E+03	6.26E+01	5.00E+03	6.22E+01

X/Q = 1.03E-04 s/m^3

Monitor efficiencies from ERS-SFL-85-031 | Pre-release Iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01) | Release (uCi/s) CF for TEDE = 9.40E+04 (Expression 5)

VS-111 HR SA9 | Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s | Release (uCi/s) CF for Child Thyroid = 9.45E+03 (Expression 5)

Isotope	U1 only SB LOCA (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	5.84E+01	2.00E-06	3.58E-01	7.13E-07	0.00E+00	0.00E+00	5.87E+00	2.01E-07	3.58E-01	7.17E-08
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.09E+02	7.13E-06	2.17E+01	1.55E-04	0.00E+00	0.00E+00	2.10E+01	7.17E-07	2.17E+01	1.56E-05
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	1.85E+04	6.33E-04	7.98E-01	5.05E-04	0.00E+00	0.00E+00	1.86E+03	6.36E-05	7.98E-01	5.08E-05
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.32E+02	4.52E-06	1.09E+02	4.93E-04	0.00E+00	0.00E+00	1.33E+01	4.54E-07	1.09E+02	4.96E-05
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.82E+01	3.85E+02	1.31E-05	2.69E+02	3.53E-03	0.00E+00	0.00E+00	3.87E+01	1.32E-06	2.69E+02	3.55E-04
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.38E+00	1.15E-07	2.52E+02	2.91E-05	0.00E+00	0.00E+00	3.40E-01	1.16E-08	2.52E+02	2.93E-06
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	7.86E+02	2.69E-05	2.76E+00	7.44E-05	0.00E+00	0.00E+00	7.92E+01	2.71E-06	2.76E+00	7.48E-06
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.06E+02	2.41E-05	5.71E+00	1.38E-04	0.00E+00	0.00E+00	7.10E+01	2.42E-06	5.71E+00	1.38E-05
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	4.74E+04	1.62E-03	2.83E+00	4.58E-03	0.00E+00	0.00E+00	4.76E+03	1.63E-04	2.83E+00	4.61E-04
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.09E+04	7.14E-04	6.92E+01	4.23E-02	0.00E+00	0.00E+00	2.10E+03	7.18E-05	5.92E+01	4.25E-03
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	4.69E+03	1.60E-04	3.41E+01	5.46E-03	0.00E+00	0.00E+00	4.72E+02	1.61E-05	3.41E+01	5.49E-04
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.02E+01	3.49E-07	2.58E+01	9.02E-06	0.00E+00	0.00E+00	1.03E+00	3.51E-08	2.58E+01	9.07E-07
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.11E+01	2.43E-06	1.55E+02	3.76E-04	0.00E+00	0.00E+00	7.14E+00	2.44E-07	1.55E+02	3.78E-05
I-131	9.92E-02	2.48E-04	4.66E+05	1.16E+02	2.33E+01	7.95E-07	2.62E+00	2.08E-06	2.44E+07	6.04E+03	2.34E+00	7.99E-08	2.62E+00	2.09E-07
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.39E+01	8.18E-07	1.58E+01	1.29E-05	2.80E+05	7.38E+01	2.40E+00	8.22E-08	1.58E+01	1.29E-06
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.03E+01	1.38E-06	4.17E+00	5.75E-06	5.77E+06	2.48E+03	4.06E+00	1.39E-07	4.17E+00	5.78E-07
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	2.77E+01	9.46E-07	1.81E+01	1.71E-05	7.60E+04	2.24E+01	2.78E+00	9.51E-08	1.81E+01	1.72E-06
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.07E+01	1.05E-06	1.08E+01	1.14E-05	1.19E+06	3.89E+02	3.09E+00	1.06E-07	1.08E+01	1.14E-06
	4.01E+02			9.05E+02				5.77E-02		9.00E+03		3.23E-04		5.80E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	5.77E+00	5.00E+02	2.90E+00
5.00E+01	2.89E+00	2.50E+02	1.45E+00
1.00E+03	5.77E+01	5.00E+03	2.90E+01

X/Q = 1.03E-04 s/m^3

Monitor efficiencies from ERS-SFL-85-031 | Pre-release Iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01) | Release (uCi/s) CF for TEDE = 1.98E+05 (Expression 5)

VS-111 HR SA9 | Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s | Release (uCi/s) CF for Child Thyroid = 1.09E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	4.89E+02	1.67E-05	3.58E-01	5.98E-06	0.00E+00	0.00E+00	2.70E+02	9.23E-06	3.58E-01	3.30E-06
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.17E+03	3.99E-05	2.17E+01	8.65E-04	0.00E+00	0.00E+00	6.45E+02	2.20E-05	2.17E+01	4.78E-04
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	2.84E+03	9.71E-05	7.98E-01	7.75E-05	0.00E+00	0.00E+00	1.57E+03	5.37E-05	7.98E-01	4.28E-05
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	6.68E+02	2.28E-05	1.09E+02	2.49E-03	0.00E+00	0.00E+00	3.69E+02	1.26E-05	1.09E+02	1.38E-03
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.09E+03	7.13E-05	2.69E+02	1.92E-02	0.00E+00	0.00E+00	1.15E+03	3.94E-05	2.69E+02	1.06E-02
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	4.81E+01	1.65E-06	2.52E+02	4.15E-04	0.00E+00	0.00E+00	2.66E+01	9.09E-07	2.52E+02	2.29E-04
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.38E+03	8.14E-05	2.76E+00	2.25E-04	0.00E+00	0.00E+00	1.32E+03	4.50E-05	2.76E+00	1.24E-04
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	2.86E+03	9.76E-05	5.71E+00	5.57E-04	0.00E+00	0.00E+00	1.58E+03	5.39E-05	5.71E+00	3.08E-04
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.69E+05	5.78E-03	2.83E+00	1.64E-02	0.00E+00	0.00E+00	9.34E+04	3.19E-03	2.83E+00	9.03E-03
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	1.82E+03	6.21E-05	6.92E+01	3.68E-03	0.00E+00	0.00E+00	1.00E+03	3.43E-05	5.92E+01	2.03E-03
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.36E+04	4.64E-04	3.41E+01	1.58E-02	0.00E+00	0.00E+00	7.50E+03	2.56E-04	3.41E+01	8.74E-03
Xe-137	9.68E+00	6.26E-04	9.55E+02	5.99E-01	1.24E+02	4.24E-06	2.58E+01	1.09E-04	0.00E+00	0.00E+00	6.85E+01	2.34E-06	2.58E+01	6.04E-05
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.33E+02	1.48E-06	1.55E+02	2.29E-03	0.00E+00	0.00E+00	2.39E+02	8.17E-06	1.55E+02	1.26E-03
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	5.80E+00	1.98E-07	2.62E+00	5.19E-07	2.44E+07	7.17E+02	3.20E+00	1.10E-07	2.62E+00	2.87E-07
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.00E-01	6.83E-09	1.58E+01	1.08E-07	2.90E+05	2.93E-01	1.10E-01	3.77E-09	1.58E+01	5.94E-08
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	1.98E+00	6.78E-08	4.17E+00	2.83E-07	5.77E+06	6.80E+01	1.10E+00	3.75E-08	4.17E+00	1.56E-07
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.19E-01	4.06E-09	1.81E+01	7.34E-08	7.60E+04	4.58E-02	6.57E-02	2.25E-09	1.81E+01	4.05E-08
I-135	5.80E-02	3.76E-06	7.10E+04	2.87E-01	7.43E-01	2.54E-08	1.08E+01	2.75E-07	1.19E+06	4.47E+00	4.10E-01	1.40E-08	1.08E+01	1.52E-07
	1.54E+04			4.31E+02				6.20E-02		7.79E+02		3.73E-03		3.43E-02

TEDE	cpm	Child Thyroid	cpm
1.00E+02	6.20E+00	5.00E+02	1.71E+01
5.00E+01	3.10E+00	2.50E+02	8.57E+00
1.00E+03	6.20E+01	5.00E+03	1.71E+02

X/Q = 1.03E-04 s/m³
Monitor efficiencies from ERS-SFL-85-031 — Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01) — Release (uCi/s) CF for TEDE = 1.17E+05 (Expression 5)
VS-101B Victoreen — Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s — Release (uCi/s) CF for Child Thyroid = 5.16E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.37E+02	8.11E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E+01	3.56E-07	0.00E+00	0.00E+00
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	5.82E+02	1.99E-06	9.80E+07	1.85E+03	0.00E+00	0.00E+00	2.56E+01	8.74E-07	9.80E+07	8.56E+01
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.34E+03	1.14E-04	3.88E+05	4.43E+01	0.00E+00	0.00E+00	1.47E+02	5.02E-06	3.88E+05	1.95E+00
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.22E+02	7.60E-06	7.38E+07	5.61E+02	0.00E+00	0.00E+00	9.78E+00	3.34E-07	7.38E+07	2.46E+01
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	9.43E+02	3.22E-05	1.14E+08	3.67E+03	0.00E+00	0.00E+00	4.14E+01	1.42E-06	1.14E+08	1.61E+02
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	1.97E-01	6.75E-09	1.39E+08	9.38E-01	0.00E+00	0.00E+00	8.68E-03	2.98E-10	1.39E+08	4.12E-02
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	1.91E+03	6.53E-05	2.25E+06	1.47E+02	0.00E+00	0.00E+00	8.40E+01	2.87E-06	2.25E+06	6.47E+00
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.67E+03	5.70E-05	1.26E+07	7.18E+02	0.00E+00	0.00E+00	7.32E+01	2.50E-06	1.26E+07	3.16E+01
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	9.79E+04	3.35E-03	1.01E+07	3.36E+04	0.00E+00	0.00E+00	4.30E+03	1.47E-04	1.01E+07	1.48E+03
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.26E+03	1.12E-04	7.15E+07	7.98E+03	0.00E+00	0.00E+00	1.43E+02	4.90E-06	7.15E+07	3.51E+02
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.14E+03	2.44E-04	1.12E+08	2.73E+04	0.00E+00	0.00E+00	3.14E+02	1.07E-05	1.12E+08	1.20E+03
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	6.71E-01	2.29E-08	3.16E+07	7.26E-01	0.00E+00	0.00E+00	2.95E-02	1.01E-09	3.16E+07	3.19E-02
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.05E+01	7.02E-07	1.15E+08	8.09E+01	0.00E+00	0.00E+00	9.02E-01	3.08E-08	1.15E+08	3.56E+00
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	7.19E+01	2.46E-06	1.02E+08	2.50E+02	2.44E+07	1.49E+04	3.16E+00	1.08E-07	1.02E+08	1.10E+01
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.48E+01	1.19E-06	2.37E+08	2.82E+02	2.90E+05	8.58E+01	1.53E+00	5.22E-08	2.37E+08	1.24E+01
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	2.79E+01	9.54E-07	8.98E+07	8.57E+01	5.77E+06	1.37E+03	1.23E+00	4.19E-08	8.98E+07	3.76E+00
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.71E+00	5.86E-08	2.36E+08	1.38E+01	7.60E+04	1.11E+00	7.53E-02	2.57E-09	2.36E+08	6.07E-01
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	8.90E+00	3.04E-07	1.02E+08	3.09E+01	1.19E+06	9.02E+01	3.91E-01	1.34E-08	1.02E+08	1.36E+00
	4.46E+04			7.24E+02				7.68E+04		1.65E+04		1.76E-04		3.37E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	7.68E+06	5.00E+02	1.69E+06
5.00E+01	3.84E+06	2.50E+02	8.43E+05
1.00E+03	7.68E+07	5.00E+03	1.69E+07

X/Q = 1.03E-04 s/m³
Monitor efficiencies from ERS-SFL-85-031 — Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01) — Release (uCi/s) CF for TEDE = 1.36E+05 (Expression 5)
VS-101B Victoreen — Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s — Release (uCi/s) CF for Child Thyroid = 7.70E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	2.78E+02	9.51E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E+01	5.39E-07	0.00E+00	0.00E+00
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	6.82E+02	2.33E-05	9.80E+07	2.28E+03	0.00E+00	0.00E+00	3.87E+01	1.32E-06	9.80E+07	1.29E+02
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	1.96E+03	6.71E-05	3.88E+05	2.60E+01	0.00E+00	0.00E+00	1.11E+02	3.80E-06	3.88E+05	1.47E+00
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.61E+02	8.93E-06	7.38E+07	6.58E+02	0.00E+00	0.00E+00	1.48E+01	5.06E-07	7.38E+07	3.73E+01
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.11E+03	3.78E-05	1.14E+08	4.31E+03	0.00E+00	0.00E+00	6.28E+01	2.14E-06	1.14E+08	2.44E+02
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.32E-01	7.92E-09	1.39E+08	1.10E+00	0.00E+00	0.00E+00	1.31E-02	4.49E-10	1.39E+08	6.25E-02
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.24E+03	7.66E-05	2.25E+06	1.73E+02	0.00E+00	0.00E+00	1.27E+02	4.34E-06	2.25E+06	9.79E+00
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	1.96E+03	6.71E-05	1.26E+07	8.46E+02	0.00E+00	0.00E+00	1.11E+02	3.80E-06	1.26E+07	4.80E+01
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.15E+05	3.92E-03	1.01E+07	3.94E+04	0.00E+00	0.00E+00	6.51E+03	2.23E-04	1.01E+07	2.24E+03
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	3.83E+03	1.31E-04	7.15E+07	9.37E+03	0.00E+00	0.00E+00	2.17E+02	7.43E-06	7.15E+07	5.31E+02
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	8.38E+03	2.86E-04	1.12E+08	3.21E+04	0.00E+00	0.00E+00	4.75E+02	1.62E-05	1.12E+08	1.82E+03
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	7.87E-01	2.69E-08	3.16E+07	8.51E-01	0.00E+00	0.00E+00	4.46E-02	1.52E-09	3.16E+07	4.82E-02
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.41E+01	8.24E-07	1.15E+08	9.50E+01	0.00E+00	0.00E+00	1.37E+00	4.67E-08	1.15E+08	5.39E+00
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.27E+01	1.80E-06	1.02E+08	1.83E+02	2.44E+07	9.48E+03	2.99E+00	1.02E-07	1.02E+08	1.04E+01
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.08E+01	1.39E-06	2.37E+08	3.31E+02	2.90E+05	8.72E+01	2.31E+00	7.91E-08	2.37E+08	1.88E+01
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.28E+01	1.12E-06	8.98E+07	1.01E+02	5.77E+06	1.39E+03	1.86E+00	6.35E-08	8.98E+07	5.71E+00
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.01E+00	6.87E-08	2.36E+08	1.62E+01	7.60E+04	1.13E+00	1.14E-01	3.89E-09	2.36E+08	9.19E-01
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.04E+01	3.57E-07	1.02E+08	3.62E+01	1.19E+06	9.15E+01	5.92E-01	2.02E-08	1.02E+08	2.05E+00
	8.78E+05			6.27E+02				9.00E+04		1.10E+04		2.63E-04		5.10E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	9.00E+06	5.00E+02	2.55E+06
5.00E+01	4.50E+06	2.50E+02	1.28E+06
1.00E+03	9.00E+07	5.00E+03	2.55E+07

Monitor efficiencies from ERS-SFL-85-031
VS-101B Victoreen

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m^3
Release (uCi/s) CF for TEDE = 6.41E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.64E+04 (Expression 5)

Isotope	U1 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.46E+01	4.98E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.06E-01	2.75E-08	0.00E+00	0.00E+00
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.02E+01	2.06E-06	9.80E+07	2.01E+02	0.00E+00	0.00E+00	3.32E+00	1.14E-07	9.80E+07	1.11E+01
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.56E+05	1.22E-02	3.88E+05	4.71E+03	0.00E+00	0.00E+00	1.97E+04	6.72E-04	3.88E+05	2.60E+02
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	7.66E+00	2.62E-07	7.38E+07	1.93E+01	0.00E+00	0.00E+00	4.23E-01	1.45E-08	7.38E+07	1.07E+00
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	6.55E+01	2.24E-06	1.14E+08	2.55E+02	0.00E+00	0.00E+00	3.62E+00	1.24E-07	1.14E+08	1.41E+01
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.18E-04	1.09E-11	1.39E+08	1.51E-03	0.00E+00	0.00E+00	1.76E-05	6.00E-13	1.39E+08	8.34E-05
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.28E+04	4.39E-04	2.25E+06	9.89E+02	0.00E+00	0.00E+00	7.09E+02	2.42E-05	2.25E+06	5.46E+01
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	1.97E+03	6.73E-05	1.26E+07	8.48E+02	0.00E+00	0.00E+00	1.09E+02	3.72E-06	1.26E+07	4.69E+01
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	2.70E+05	9.22E-03	1.01E+07	9.27E+04	0.00E+00	0.00E+00	1.49E+04	5.09E-04	1.01E+07	5.12E+03
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.32E+02	4.50E-06	7.15E+07	3.22E+02	0.00E+00	0.00E+00	7.27E+00	2.49E-07	7.15E+07	1.78E+01
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.02E+02	6.92E-06	1.12E+08	7.75E+02	0.00E+00	0.00E+00	1.12E+01	3.82E-07	1.12E+08	4.28E+01
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.29E-03	4.42E-11	3.16E+07	1.40E-03	0.00E+00	0.00E+00	7.15E-05	2.44E-12	3.16E+07	7.74E-05
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.44E-01	4.91E-09	1.15E+08	5.66E-01	0.00E+00	0.00E+00	7.94E-03	2.71E-10	1.15E+08	3.13E-02
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	5.89E+01	2.01E-06	1.02E+08	2.04E+02	2.44E+07	2.24E+03	3.25E+00	1.11E-07	1.02E+08	1.13E+01
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	3.94E+01	1.35E-06	2.37E+08	3.19E+02	2.90E+05	1.78E+01	2.18E+00	7.44E-08	2.37E+08	1.76E+01
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.50E+01	5.13E-07	8.98E+07	4.61E+01	5.77E+06	1.35E+02	8.30E-01	2.84E-08	8.98E+07	2.55E+00
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	3.93E-01	1.34E-08	2.36E+08	3.17E+00	7.60E+04	4.66E-02	2.17E-02	7.42E-10	2.36E+08	1.75E-01
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.09E+00	1.40E-07	1.02E+08	1.42E+01	1.19E+06	7.59E+00	2.26E-01	7.72E-09	1.02E+08	7.84E-01
	5.89E+01			1.33E+02				1.01E+05		2.40E+03		1.21E-03		5.60E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.01E+07	5.00E+02	2.80E+06
5.00E+01	5.07E+06	2.50E+02	1.40E+06
1.00E+03	1.01E+08	5.00E+03	2.80E+07

Monitor efficiencies from ERS-SFL-85-031
VS-101B Victoreen

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.005)
Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m^3
Release (uCi/s) CF for TEDE = 2.03E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 4.04E+03 (Expression 5)

Isotope	U1 only LOCA TID (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.65E+02	9.07E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.28E+01	1.80E-06	0.00E+00	0.00E+00
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	5.47E+02	1.87E-05	9.80E+07	1.83E+03	0.00E+00	0.00E+00	1.09E+02	3.72E-06	9.80E+07	3.64E+02
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.32E+01	7.92E-07	3.88E+05	3.07E-01	0.00E+00	0.00E+00	4.61E+00	1.58E-07	3.88E+05	6.11E-02
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.10E+03	3.75E-05	7.38E+07	2.76E+03	0.00E+00	0.00E+00	2.18E+02	7.45E-06	7.38E+07	5.50E+02
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.52E+03	5.20E-05	1.14E+08	5.93E+03	0.00E+00	0.00E+00	3.03E+02	1.04E-05	1.14E+08	1.18E+03
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	1.89E+03	6.47E-05	1.39E+08	8.99E+03	0.00E+00	0.00E+00	3.77E+02	1.29E-05	1.39E+08	1.79E+03
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.03E+01	1.03E-06	2.25E+06	2.33E+00	0.00E+00	0.00E+00	6.03E+00	2.06E-07	2.25E+06	4.64E-01
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.42E+02	4.84E-06	1.26E+07	6.10E+01	0.00E+00	0.00E+00	2.82E+01	9.63E-07	1.26E+07	1.21E+01
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	4.49E+03	1.53E-04	1.01E+07	1.54E+03	0.00E+00	0.00E+00	8.93E+02	3.05E-05	1.01E+07	3.07E+02
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	9.42E+02	3.22E-05	7.15E+07	2.30E+03	0.00E+00	0.00E+00	1.87E+02	6.41E-06	7.15E+07	4.58E+02
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.36E+03	4.64E-05	1.12E+08	5.20E+03	0.00E+00	0.00E+00	2.70E+02	9.23E-06	1.12E+08	1.03E+03
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.09E+03	1.40E-04	3.16E+07	4.43E+03	0.00E+00	0.00E+00	8.15E+02	2.78E-05	3.16E+07	8.81E+02
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	3.81E+03	1.30E-04	1.15E+08	1.50E+04	0.00E+00	0.00E+00	7.59E+02	2.59E-05	1.15E+08	2.99E+03
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.09E+01	3.73E-07	1.02E+08	3.79E+01	2.44E+07	1.31E+04	2.17E+00	7.42E-08	1.02E+08	7.53E+00
I-132	5.70E+06	7.87E-04	4.33E+04	3.41E+01	1.60E+01	5.46E-07	2.37E+08	1.30E+02	2.90E+05	2.28E+02	3.18E+00	1.09E-07	2.37E+08	2.58E+01
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.24E+01	7.67E-07	8.98E+07	6.89E+01	5.77E+06	6.37E+03	4.46E+00	1.53E-07	8.98E+07	1.37E+01
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.48E+01	8.48E-07	2.36E+08	2.00E+02	7.60E+04	9.29E+01	4.94E+00	1.69E-07	2.36E+08	3.98E+01
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.13E+01	7.28E-07	1.02E+08	7.39E+01	1.19E+06	1.26E+03	4.24E+00	1.45E-07	1.02E+08	1.47E+01
	7.24E+08			4.19E+03				4.86E+04		2.10E+04		1.38E-04		9.67E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.86E+06	5.00E+02	4.83E+06
5.00E+01	2.43E+06	2.50E+02	2.42E+06
1.00E+03	4.86E+07	5.00E+03	4.83E+07

Monitor efficiencies from ERS-SFL-85-031 — Pre-release Iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)

VS-101B Victoreen — Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m³

Release (uCi/s) CF for TEDE = 9.40E+04 (Expression 5)

Release (uCi/s) CF for Child Thyroid = 9.45E+03 (Expression 5)

Isotope	U1 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	5.84E+01	2.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.87E+00	2.01E-07	0.00E+00	0.00E+00
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.09E+02	7.13E-06	9.80E+07	6.99E+02	0.00E+00	0.00E+00	2.10E+01	7.17E-07	9.80E+07	7.02E+01
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	1.85E+04	6.33E-04	3.88E+05	2.45E+02	0.00E+00	0.00E+00	1.86E+03	6.36E-05	3.88E+05	2.47E+01
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.32E+02	4.52E-06	7.38E+07	3.33E+02	0.00E+00	0.00E+00	1.33E+01	4.54E-07	7.38E+07	3.35E+01
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	3.85E+02	1.31E-05	1.14E+08	1.50E+03	0.00E+00	0.00E+00	3.87E+01	1.32E-06	1.14E+08	1.50E+02
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.38E+00	1.15E-07	1.39E+08	1.60E+01	0.00E+00	0.00E+00	3.40E-01	1.16E-08	1.39E+08	1.61E+00
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	7.88E+02	2.69E-05	2.25E+06	6.07E+01	0.00E+00	0.00E+00	7.92E+01	2.71E-06	2.25E+06	6.10E+00
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.06E+02	2.41E-05	1.26E+07	3.04E+02	0.00E+00	0.00E+00	7.10E+01	2.42E-06	1.26E+07	3.06E+01
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	4.74E+04	1.62E-03	1.01E+07	1.63E+04	0.00E+00	0.00E+00	4.76E+03	1.63E-04	1.01E+07	1.64E+03
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.09E+04	7.14E-04	7.15E+07	5.11E+04	0.00E+00	0.00E+00	2.10E+03	7.18E-05	7.15E+07	5.14E+03
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	4.69E+03	1.60E-04	1.12E+08	1.80E+04	0.00E+00	0.00E+00	4.72E+02	1.61E-05	1.12E+08	1.81E+03
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.02E+01	3.49E-07	3.16E+07	1.11E+01	0.00E+00	0.00E+00	1.03E+00	3.51E-08	3.16E+07	1.11E+00
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.11E+01	2.43E-06	1.15E+08	2.80E+02	0.00E+00	0.00E+00	7.14E+00	2.44E-07	1.15E+08	2.81E+01
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.33E+01	7.95E-07	1.02E+08	8.08E+01	2.44E+07	6.04E+03	2.34E+00	7.99E-08	1.02E+08	8.12E+00
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.39E+01	8.16E-07	2.37E+08	1.94E+02	2.90E+05	7.38E+01	2.40E+00	8.22E-08	2.37E+08	1.95E+01
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.03E+01	1.38E-06	8.98E+07	1.24E+02	5.77E+06	2.48E+03	4.06E+00	1.39E-07	8.98E+07	1.24E+01
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	2.77E+01	9.46E-07	2.36E+08	2.23E+02	7.60E+04	2.24E+01	2.78E+00	9.51E-08	2.36E+08	2.24E+01
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.07E+01	1.05E-06	1.02E+08	1.07E+02	1.19E+06	3.89E+02	3.09E+00	1.06E-07	1.02E+08	1.07E+01
	4.01E+02			9.05E+02				8.95E+04		9.00E+03		3.23E-04		9.00E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	8.95E+06	5.00E+02	4.50E+06
5.00E+01	4.48E+06	2.50E+02	2.25E+06
1.00E+03	8.95E+07	5.00E+03	4.50E+07

Monitor efficiencies from ERS-SFL-85-031 — Pre-release Iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.01)

VS-101B Victoreen — Release Flow Rate = 6.20E+04 cfm : 2.93E+07 cc/s

X/Q = 1.03E-04 s/m³

Release (uCi/s) CF for TEDE = 1.98E+05 (Expression 5)

Release (uCi/s) CF for Child Thyroid = 1.09E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	4.89E+02	1.67E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.70E+02	9.23E-06	0.00E+00	0.00E+00
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.17E+03	3.99E-05	9.80E+07	3.91E+03	0.00E+00	0.00E+00	6.45E+02	2.20E-05	9.80E+07	2.16E+03
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	2.84E+03	9.71E-05	3.88E+05	3.76E+01	0.00E+00	0.00E+00	1.57E+03	5.37E-05	3.88E+05	2.08E+01
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	6.68E+02	2.28E-05	7.38E+07	1.68E+03	0.00E+00	0.00E+00	3.69E+02	1.26E-05	7.38E+07	9.31E+02
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.09E+03	7.13E-05	1.14E+08	8.12E+03	0.00E+00	0.00E+00	1.15E+03	3.94E-05	1.14E+08	4.49E+03
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	4.81E+01	1.65E-06	1.39E+08	2.29E+02	0.00E+00	0.00E+00	2.66E+01	9.09E-07	1.39E+08	1.26E+02
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.38E+03	8.14E-05	2.25E+06	1.83E+02	0.00E+00	0.00E+00	1.32E+03	4.50E-05	2.25E+06	1.01E+02
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.16E+00	2.86E+03	9.76E-05	1.26E+07	1.23E+03	0.00E+00	0.00E+00	1.58E+03	5.39E-05	1.26E+07	6.80E+02
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.69E+05	5.78E-03	1.01E+07	5.80E+04	0.00E+00	0.00E+00	9.34E+04	3.19E-03	1.01E+07	3.21E+04
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	1.82E+03	6.21E-05	7.15E+07	4.44E+03	0.00E+00	0.00E+00	1.00E+03	3.43E-05	7.15E+07	2.46E+03
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.36E+04	4.64E-04	1.12E+08	5.20E+04	0.00E+00	0.00E+00	7.50E+03	2.56E-04	1.12E+08	2.87E+04
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.24E+02	4.24E-06	3.16E+07	1.34E+02	0.00E+00	0.00E+00	6.85E+01	2.34E-06	3.16E+07	7.40E+01
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.33E+02	1.48E-05	1.15E+08	1.71E+03	0.00E+00	0.00E+00	2.39E+02	8.17E-06	1.16E+08	9.42E+02
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	5.80E+00	1.98E-07	1.02E+08	2.01E+01	2.44E+07	7.17E+02	3.20E+00	1.10E-07	1.02E+08	1.11E+01
I-132	1.58E-02	1.01E-06	4.33E+04	4.38E-02	2.00E-01	6.83E-09	2.37E+08	1.62E+00	2.90E+05	2.93E-01	1.10E-01	3.77E-09	2.37E+08	8.95E-01
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	1.98E+00	6.76E-08	8.98E+07	6.09E+00	5.77E+06	5.80E+01	1.10E+00	3.75E-08	8.98E+07	3.37E+00
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.19E-01	4.06E-09	2.36E+08	9.59E-01	7.60E+04	4.58E-02	6.57E-02	2.25E-09	2.36E+08	5.30E-01
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	7.43E-01	2.54E-08	1.02E+08	2.58E+00	1.19E+06	4.47E+00	4.10E-01	1.40E-08	1.02E+08	1.42E+00
	1.54E+04			4.31E+02				1.32E+05		7.79E+02		3.73E-03		7.28E+04

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.32E+07	5.00E+02	3.64E+07
5.00E+01	6.59E+06	2.50E+02	1.82E+07
1.00E+03	1.32E+08	5.00E+03	3.64E+08

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

Subject:

BVPS-U1 Gaseous Radioactivity Monitor Emergency Action Levels

No.: **ERS-MPD-93-007 Attachment 3**

REVISION: 6

X/Q = 9.24E-05 s/m^3

Monitor efficiencies from ERS-SFL-85-031 — Upstream filtration (iodines reduced 0.01) — Release (uCi/s) CF for TEDE = 1.31E+05 (Expression 5)

SPING VS-110 Channel 5 — Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s — Release (uCi/s) CF for Child Thyroid = 5.75E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.64E+02	1.14E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E+01	4.99E-07	0.00E+00	0.00E+00
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	6.49E+02	2.79E-05	2.57E+07	7.17E+02	0.00E+00	0.00E+00	2.85E+01	1.22E-06	2.57E+07	3.15E+01
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.73E+03	1.60E-04	2.67E+07	4.27E+03	0.00E+00	0.00E+00	1.64E+02	7.04E-06	2.67E+07	1.88E+02
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.48E+02	1.07E-05	3.19E+07	3.39E+02	0.00E+00	0.00E+00	1.09E+01	4.68E-07	3.19E+07	1.49E+01
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	1.05E+03	4.52E-05	2.28E+07	1.03E+03	0.00E+00	0.00E+00	4.62E+01	1.98E-06	2.28E+07	4.52E+01
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	2.20E-01	9.46E-09	3.16E+07	2.99E-01	0.00E+00	0.00E+00	9.67E-03	4.16E-10	3.16E+07	1.31E-02
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	2.13E+03	9.16E-05	1.86E+07	1.71E+03	0.00E+00	0.00E+00	9.36E+01	4.02E-06	1.86E+07	7.50E+01
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.86E+03	7.98E-05	2.09E+07	1.67E+03	0.00E+00	0.00E+00	8.16E+01	3.51E-06	2.09E+07	7.32E+01
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	1.09E+05	4.69E-03	1.33E+07	6.25E+04	0.00E+00	0.00E+00	4.80E+03	2.06E-04	1.33E+07	2.75E+03
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.64E+03	1.56E-04	6.15E+06	9.62E+02	0.00E+00	0.00E+00	1.60E+02	6.87E-06	6.15E+06	4.23E+01
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.95E+03	3.42E-04	3.14E+07	1.07E+04	0.00E+00	0.00E+00	3.49E+02	1.50E-05	3.14E+07	4.71E+02
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	7.48E-01	3.22E-08	3.19E+07	1.03E+00	0.00E+00	0.00E+00	3.29E-02	1.41E-09	3.19E+07	4.51E-02
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.29E+01	9.84E-07	2.87E+07	2.82E+01	0.00E+00	0.00E+00	1.01E+00	4.32E-08	2.87E+07	1.24E+00
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	8.01E+01	3.44E-06	1.02E+06	3.50E+00	2.44E+07	1.49E+04	3.52E+00	1.51E-07	1.02E+06	1.54E-01
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.87E+01	1.66E-06	1.55E+06	2.59E+00	2.90E+05	8.58E+01	1.70E+00	7.32E-08	1.55E+06	1.14E-01
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	3.11E+01	1.34E-06	1.57E+06	2.09E+00	5.77E+06	1.37E+03	1.37E+00	5.87E-08	1.57E+06	9.19E-02
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.91E+00	8.21E-08	1.60E+06	1.32E-01	7.60E+04	1.11E+00	8.39E-02	3.61E-09	1.60E+06	5.79E-03
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	9.92E+00	4.26E-07	1.42E+06	8.05E-01	1.19E+06	9.02E+01	4.36E-01	1.87E-08	1.42E+06	2.66E-02
	4.46E+04			7.24E+02				8.40E+04		1.65E+04		2.47E-04		3.69E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	8.40E+06	5.00E+02	1.85E+06
5.00E+01	4.20E+06	2.50E+02	9.23E+05
1.00E+03	8.40E+07	5.00E+03	1.85E+07

X/Q = 9.24E-05 s/m^3

Monitor efficiencies from ERS-SFL-85-031 — Upstream filtration (iodines reduced 0.01) — Release (uCi/s) CF for TEDE = 1.51E+05 (Expression 5)

SPING VS-110 Channel 5 — Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s — Release (uCi/s) CF for Child Thyroid = 8.58E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	3.10E+02	1.33E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E+01	7.56E-07	0.00E+00	0.00E+00
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	7.60E+02	3.27E-05	2.57E+07	8.41E+02	0.00E+00	0.00E+00	4.31E+01	1.85E-06	2.57E+07	4.77E+01
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	2.19E+03	9.40E-05	2.67E+07	2.51E+03	0.00E+00	0.00E+00	1.24E+02	5.33E-06	2.67E+07	1.42E+02
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.91E+02	1.25E-05	3.19E+07	3.99E+02	0.00E+00	0.00E+00	1.65E+01	7.10E-07	3.19E+07	2.26E+01
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.23E+03	5.30E-05	2.28E+07	1.21E+03	0.00E+00	0.00E+00	7.00E+01	3.01E-06	2.28E+07	6.84E+01
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.58E-01	1.11E-08	3.16E+07	3.51E-01	0.00E+00	0.00E+00	1.47E-02	6.30E-10	3.16E+07	1.99E-02
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.50E+03	1.07E-04	1.86E+07	2.00E+03	0.00E+00	0.00E+00	1.42E+02	6.09E-06	1.86E+07	1.14E+02
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	2.19E+03	9.40E-05	2.09E+07	1.96E+03	0.00E+00	0.00E+00	1.24E+02	5.33E-06	2.09E+07	1.11E+02
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.28E+05	5.50E-03	1.33E+07	7.33E+04	0.00E+00	0.00E+00	7.26E+03	3.12E-04	1.33E+07	4.16E+03
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	4.27E+03	1.84E-04	6.15E+06	1.13E+03	0.00E+00	0.00E+00	2.42E+02	1.04E-05	6.15E+06	6.41E+01
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	9.34E+03	4.01E-04	3.14E+07	1.26E+04	0.00E+00	0.00E+00	5.30E+02	2.28E-05	3.14E+07	7.14E+02
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	8.77E-01	3.77E-08	3.19E+07	1.20E+00	0.00E+00	0.00E+00	4.97E-02	2.14E-09	3.19E+07	6.82E-02
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.69E+01	1.16E-06	2.87E+07	3.31E+01	0.00E+00	0.00E+00	1.52E+00	6.55E-08	2.87E+07	1.88E+00
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.88E+01	2.53E-06	1.02E+06	2.57E+00	2.44E+07	9.48E+03	3.33E+00	1.43E-07	1.02E+06	1.45E-01
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.55E+01	1.96E-06	1.55E+06	3.04E+00	2.90E+05	8.72E+01	2.58E+00	1.11E-07	1.55E+06	1.72E-01
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.65E+01	1.57E-06	1.57E+06	2.46E+00	5.77E+06	1.39E+03	2.07E+00	8.90E-08	1.57E+06	1.39E-01
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.24E+00	9.63E-08	1.60E+06	1.54E-01	7.60E+04	1.13E+00	1.27E-01	5.46E-09	1.60E+06	8.76E-03
I-135	6.75E+01	7.69E-05	7.10E+04	5.48E+00	1.16E+01	5.00E-07	1.42E+06	7.09E-01	1.19E+06	9.15E+01	6.60E-01	2.83E-08	1.42E+06	4.02E-02
	8.78E+05			6.27E+02				9.60E+04		1.10E+04		3.69E-04		5.45E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	9.60E+06	5.00E+02	2.72E+06
5.00E+01	4.80E+06	2.50E+02	1.36E+06
1.00E+03	9.60E+07	5.00E+03	2.72E+07

X/Q = 9.24E-05 s/m^3
Monitor efficiencies from ERS-SFL-85-031 Upstream filtration (iodines reduced 0.01) Release (uCi/s) CF for TEDE = 7.15E+05 (Expression 5)
SPING VS-110 Channel 5 Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s Release (uCi/s) CF for Child Thyroid = 3.95E+04 (Expression 5)

Isotope	U1 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.63E+01	6.99E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.98E-01	3.86E-08	0.00E+00	0.00E+00
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.71E+01	2.88E-06	2.57E+07	7.42E+01	0.00E+00	0.00E+00	3.71E+00	1.59E-07	2.57E+07	4.10E+00
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.97E+05	1.70E-02	2.67E+07	4.54E+05	0.00E+00	0.00E+00	2.19E+04	9.42E-04	2.67E+07	2.51E+04
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	8.54E+00	3.67E-07	3.19E+07	1.17E+01	0.00E+00	0.00E+00	4.72E-01	2.03E-08	3.19E+07	6.46E-01
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	7.30E+01	3.14E-06	2.28E+07	7.14E+01	0.00E+00	0.00E+00	4.03E+00	1.73E-07	2.28E+07	3.95E+00
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.54E-04	1.52E-11	3.16E+07	4.81E-04	0.00E+00	0.00E+00	1.96E-05	8.41E-13	3.16E+07	2.66E-05
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.43E+04	6.15E-04	1.86E+07	1.15E+04	0.00E+00	0.00E+00	7.91E+02	3.40E-05	1.86E+07	6.33E+02
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	2.20E+03	9.44E-05	2.09E+07	1.97E+03	0.00E+00	0.00E+00	1.21E+02	5.21E-06	2.09E+07	1.09E+02
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	3.01E+05	1.29E-02	1.33E+07	1.72E+05	0.00E+00	0.00E+00	1.66E+04	7.14E-04	1.33E+07	9.52E+03
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.47E+02	6.31E-06	6.15E+06	3.88E+01	0.00E+00	0.00E+00	8.11E+00	3.48E-07	6.15E+06	2.14E+00
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.26E+02	9.70E-06	3.14E+07	3.04E+02	0.00E+00	0.00E+00	1.25E+01	5.36E-07	3.14E+07	1.68E+01
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.44E-03	6.20E-11	3.19E+07	1.98E-03	0.00E+00	0.00E+00	7.97E-05	3.43E-12	3.19E+07	1.09E-04
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.60E-01	6.86E-09	2.87E+07	1.97E-01	0.00E+00	0.00E+00	8.85E-03	3.80E-10	2.87E+07	1.09E-02
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	6.56E+01	2.82E-06	1.02E+06	2.87E+00	2.44E+07	2.24E+03	3.63E+00	1.56E-07	1.02E+06	1.58E-01
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	4.39E+01	1.89E-06	1.55E+06	2.83E+00	2.90E+05	1.78E+01	2.43E+00	1.04E-07	1.55E+06	1.62E-01
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.67E+01	7.19E-07	1.57E+06	1.13E+00	5.77E+06	1.35E+02	9.25E-01	3.97E-08	1.57E+06	6.22E-02
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	4.38E-01	1.88E-08	1.60E+06	3.02E-02	7.60E+04	4.66E-02	2.42E-02	1.04E-09	1.60E+06	1.67E-03
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.56E+00	1.96E-07	1.42E+06	2.78E-01	1.19E+06	7.59E+00	2.52E-01	1.08E-08	1.42E+06	1.54E-02
	5.89E+01			1.33E+02				6.41E+05		2.40E+03		1.70E-03		3.54E+04

TEDE	cpm	Child Thyroid	cpm
1.00E+02	6.41E+07	5.00E+02	1.77E+07
5.00E+01	3.20E+07	2.50E+02	8.85E+06
1.00E+03	6.41E+08	5.00E+03	1.77E+08

X/Q = 9.24E-05 s/m^3
Monitor efficiencies from ERS-SFL-85-031 *Pre-release Iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.005)* *Release (uCi/s) CF for TEDE =* 2.26E+04 *(Expression 5)*
SPING VS-110 Channel 5 Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s Release (uCi/s) CF for Child Thyroid = 4.50E+03 (Expression 5)

Isotope	U1 only LOCA TID (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.96E+02	1.27E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.88E+01	2.53E-06	0.00E+00	0.00E+00
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	6.10E+02	2.62E-05	2.57E+07	6.74E+02	0.00E+00	0.00E+00	1.21E+02	5.21E-06	2.57E+07	1.34E+02
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.59E+01	1.11E-06	2.67E+07	2.96E+01	0.00E+00	0.00E+00	5.14E+00	2.21E-07	2.67E+07	5.89E+00
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.22E+03	5.25E-05	3.19E+07	1.67E+03	0.00E+00	0.00E+00	2.43E+02	1.04E-05	3.19E+07	3.33E+02
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.70E+03	7.29E-05	2.28E+07	1.66E+03	0.00E+00	0.00E+00	3.38E+02	1.45E-05	2.28E+07	3.30E+02
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.61E+02	2.11E+03	9.07E-05	3.16E+07	2.86E+03	0.00E+00	0.00E+00	4.20E+02	1.80E-05	3.16E+07	5.70E+02
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.38E+01	1.45E-06	1.86E+07	2.70E+01	0.00E+00	0.00E+00	6.72E+00	2.89E-07	1.86E+07	5.38E+00
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.58E+02	6.78E-06	2.09E+07	1.42E+02	0.00E+00	0.00E+00	3.14E+01	1.35E-06	2.09E+07	2.82E+01
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	5.00E+03	2.15E-04	1.33E+07	2.87E+03	0.00E+00	0.00E+00	9.95E+02	4.28E-05	1.33E+07	5.70E+02
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	1.05E+03	4.51E-05	6.15E+06	2.78E+02	0.00E+00	0.00E+00	2.09E+02	8.98E-06	6.15E+06	5.53E+01
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.51E+03	6.50E-05	3.14E+07	2.04E+03	0.00E+00	0.00E+00	3.01E+02	1.29E-05	3.14E+07	4.06E+02
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.56E+03	1.96E-04	3.19E+07	6.26E+03	0.00E+00	0.00E+00	9.08E+02	3.90E-05	3.19E+07	1.24E+03
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	4.25E+03	1.83E-04	2.87E+07	5.24E+03	0.00E+00	0.00E+00	8.46E+02	3.63E-05	2.87E+07	1.04E+03
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.22E+01	5.23E-07	1.02E+06	5.31E-01	2.44E+07	1.31E+04	2.42E+00	1.04E-07	1.02E+06	1.06E-01
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.78E+01	7.66E-07	1.55E+06	1.19E+00	2.90E+05	2.28E+02	3.54E+00	1.52E-07	1.55E+06	2.37E-01
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.50E+01	1.07E-06	1.57E+06	1.68E+00	5.77E+06	6.37E+03	4.98E+00	2.14E-07	1.57E+06	3.35E-01
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.77E+01	1.19E-06	1.60E+06	1.91E+00	7.60E+04	9.29E+01	5.50E+00	2.37E-07	1.60E+06	3.79E-01
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.38E+01	1.02E-06	1.42E+06	1.45E+00	1.19E+06	1.25E+03	4.73E+00	2.03E-07	1.42E+06	2.88E-01
	7.24E+08			4.19E+03				2.38E+04		2.10E+04		1.94E-04		4.73E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	2.38E+06	5.00E+02	2.36E+06
5.00E+01	1.19E+06	2.50E+02	1.18E+06
1.00E+03	2.38E+07	5.00E+03	2.36E+07

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 1.05E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.05E+04 (Expression 5)

Monitor efficiencies from ERS-SFL-85-031
SPING VS-110 Channel 5

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

Isotope	U1 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	6.51E+01	2.80E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.54E+00	2.81E-07	0.00E+00	0.00E+00
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.33E+02	1.00E-05	2.57E+07	2.57E+02	0.00E+00	0.00E+00	2.34E+01	1.01E-06	2.57E+07	2.59E+01
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	2.07E+04	8.88E-04	2.67E+07	2.37E+04	0.00E+00	0.00E+00	2.08E+03	8.92E-05	2.67E+07	2.38E+03
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.47E+02	6.34E-06	3.19E+07	2.02E+02	0.00E+00	0.00E+00	1.48E+01	6.37E-07	3.19E+07	2.03E+01
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	4.29E+02	1.84E-05	2.28E+07	4.19E+02	0.00E+00	0.00E+00	4.31E+01	1.85E-06	2.28E+07	4.22E+01
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.77E+00	1.62E-07	3.16E+07	5.11E+00	0.00E+00	0.00E+00	3.78E-01	1.63E-08	3.16E+07	5.14E-01
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	8.79E+02	3.78E-05	1.86E+07	7.04E+02	0.00E+00	0.00E+00	8.83E+01	3.79E-06	1.86E+07	7.07E+01
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.87E+02	3.38E-05	2.09E+07	7.06E+02	0.00E+00	0.00E+00	7.91E+01	3.40E-06	2.09E+07	7.10E+01
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	5.28E+04	2.27E-03	1.33E+07	3.03E+04	0.00E+00	0.00E+00	5.31E+03	2.28E-04	1.33E+07	3.04E+03
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.33E+04	1.00E-03	6.15E+06	6.16E+03	0.00E+00	0.00E+00	2.34E+03	1.01E-04	6.15E+06	6.19E+02
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	5.23E+03	2.25E-04	3.14E+07	7.05E+03	0.00E+00	0.00E+00	5.26E+02	2.26E-05	3.14E+07	7.09E+02
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.14E+01	4.90E-07	3.19E+07	1.56E+01	0.00E+00	0.00E+00	1.15E+00	4.92E-08	3.19E+07	1.57E+00
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.92E+01	3.40E-06	2.87E+07	9.76E+01	0.00E+00	0.00E+00	7.96E+00	3.42E-07	2.87E+07	9.81E+00
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.59E+01	1.11E-06	1.02E+06	1.13E+00	2.44E+07	6.04E+03	2.61E+00	1.12E-07	1.02E+06	1.14E-01
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.67E+01	1.15E-06	1.55E+06	1.78E+00	2.90E+05	7.38E+01	2.68E+00	1.15E-07	1.55E+06	1.79E-01
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.50E+01	1.93E-06	1.57E+06	3.02E+00	5.77E+06	2.48E+03	4.52E+00	1.94E-07	1.57E+06	3.04E-01
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	3.09E+01	1.33E-06	1.60E+06	2.13E+00	7.60E+04	2.24E+01	3.10E+00	1.33E-07	1.60E+06	2.14E-01
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.43E+01	1.47E-06	1.42E+06	2.09E+00	1.19E+06	3.89E+02	3.44E+00	1.48E-07	1.42E+06	2.10E-01
	4.01E+02			9.05E+02				6.95E+04		9.00E+03		4.53E-04		6.99E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	6.95E+06	5.00E+02	3.50E+06
5.00E+01	3.48E+06	2.50E+02	1.75E+06
1.00E+03	6.95E+07	5.00E+03	3.50E+07

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 5.24E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.48E+05 (Expression 5)

Monitor efficiencies from ERS-SFL-85-031
SPING VS-110 Channel 5

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm , 2.33E+07 cc/s

Isotope	U1 & U2 FHA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	4.69E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85m	1.04E-03	3.07E-08	8.17E+02	2.50E-05	1.61E-02	6.90E-10	2.57E+07	1.78E-02	0.00E+00	0.00E+00	7.61E-03	3.27E-10	2.57E+07	8.42E-03
Kr-85	4.78E+02	1.41E-02	1.12E+01	1.58E-01	7.38E+03	3.17E-04	2.67E+07	8.45E+03	0.00E+00	0.00E+00	3.50E+03	1.50E-04	2.67E+07	4.01E+03
Kr-87	0.00E+00	0.00E+00	4.47E+03	0.00E+00	0.00E+00	0.00E+00	3.19E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.19E+07	0.00E+00
Kr-88	0.00E+00	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	2.28E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.28E+07	0.00E+00
Kr-89	0.00E+00	0.00E+00	1.02E+04	0.00E+00	0.00E+00	0.00E+00	3.16E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.16E+07	0.00E+00
Xe-131m	4.66E+02	1.37E-02	4.29E+01	5.89E-01	7.19E+03	3.09E-04	1.86E+07	5.75E+03	0.00E+00	0.00E+00	3.41E+03	1.47E-04	1.86E+07	2.73E+03
Xe-133m	6.16E+02	1.82E-02	1.49E+02	2.71E+00	9.51E+03	4.09E-04	2.09E+07	8.53E+03	0.00E+00	0.00E+00	4.51E+03	1.94E-04	2.09E+07	4.05E+03
Xe-133	3.23E+04	9.52E-01	1.76E+02	1.68E+02	4.99E+05	2.14E-02	1.33E+07	2.86E+05	0.00E+00	0.00E+00	2.36E+05	1.02E-02	1.33E+07	1.35E+05
Xe-135m	2.65E+00	7.81E-05	2.15E+03	1.68E-01	4.09E+01	1.76E-06	6.15E+06	1.08E+01	0.00E+00	0.00E+00	1.94E+01	8.33E-07	6.15E+06	5.13E+00
Xe-135	6.10E+01	1.80E-03	1.25E+03	2.25E+00	9.42E+02	4.05E-05	3.14E+07	1.27E+03	0.00E+00	0.00E+00	4.46E+02	1.92E-05	3.14E+07	6.02E+02
Xe-137	0.00E+00	0.00E+00	9.55E+02	0.00E+00	0.00E+00	0.00E+00	3.19E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.19E+07	0.00E+00
Xe-138	0.00E+00	0.00E+00	6.27E+03	0.00E+00	0.00E+00	0.00E+00	2.87E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.87E+07	0.00E+00
I-131	5.20E-01	1.53E-05	4.66E+05	7.14E+00	8.03E+00	3.45E-07	1.02E+06	3.50E-01	2.44E+07	3.74E+02	3.81E+00	1.64E-07	1.02E+06	1.66E-01
I-132	2.52E-01	7.43E-06	4.33E+04	3.22E-01	3.89E+00	1.67E-07	1.55E+06	2.60E-01	2.90E+05	2.15E+00	1.84E+00	7.93E-08	1.55E+06	1.23E-01
I-133	3.35E-02	9.87E-07	1.28E+05	1.26E-01	5.17E-01	2.22E-08	1.57E+06	3.48E-02	5.77E+06	5.70E+00	2.45E-01	1.05E-08	1.57E+06	1.65E-02
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	1.60E+06	0.00E+00	7.60E+04	0.00E+00	0.00E+00	0.00E+00	1.60E+06	0.00E+00
I-135	2.23E-05	6.57E-10	7.10E+04	4.67E-05	3.44E-04	1.48E-11	1.42E+06	2.10E-05	1.19E+06	7.82E-04	1.63E-04	7.01E-12	1.42E+06	9.95E-06
	3.39E+04			1.81E+02				3.10E+05		3.82E+02		1.07E-02		1.47E+05

TEDE	cpm	Child Thyroid	cpm
1.00E+02	3.10E+07	5.00E+02	7.34E+07
5.00E+01	1.55E+07	2.50E+02	3.67E+07
1.00E+03	3.10E+08	5.00E+03	7.34E+08

Monitor efficiencies from ERS-SFL-85-031 Upstream filtration (iodines reduced 0.01)
SPING VS-110 Channel 5 Release Flow Rate = 4.93E+04 cfm : 2.327E+07 cc/s

X/Q = 9.240E-05 s/m^3
Release (uCi/s) CF for TEDE = 2.202E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.216E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	5.45E+02	2.34E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.012E+02	1.295E-05	0.000E+00	0.000E+00
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.30E+03	5.59E-05	2.574E+07	1.440E+03	0.000E+00	0.000E+00	7.192E+02	3.091E-05	2.574E+07	7.956E+02
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	3.17E+03	1.36E-04	2.666E+07	3.630E+03	0.000E+00	0.000E+00	1.751E+03	7.524E-05	2.666E+07	2.006E+03
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	7.45E+02	3.20E-05	3.185E+07	1.020E+03	0.000E+00	0.000E+00	4.117E+02	1.769E-05	3.185E+07	5.634E+02
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.33E+03	1.00E-04	2.276E+07	2.275E+03	0.000E+00	0.000E+00	1.285E+03	5.524E-05	2.276E+07	1.257E+03
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	5.37E+01	2.31E-06	3.159E+07	7.285E+01	0.000E+00	0.000E+00	2.965E+01	1.274E-06	3.159E+07	4.025E+01
Xe-131m	1.86E+02	1.21E-02	4.28E+01	5.17E-01	2.65E+03	1.14E-04	1.864E+07	2.127E+03	0.000E+00	0.000E+00	1.467E+03	6.304E-05	1.864E+07	1.175E+03
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.16E+00	3.18E+03	1.37E-04	2.088E+07	2.856E+03	0.000E+00	0.000E+00	1.759E+03	7.558E-05	2.088E+07	1.578E+03
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.88E+05	8.10E-03	1.333E+07	1.079E+05	0.000E+00	0.000E+00	1.041E+05	4.474E-03	1.333E+07	5.963E+04
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	2.03E+03	8.71E-05	6.153E+06	5.359E+02	0.000E+00	0.000E+00	1.120E+03	4.812E-05	6.153E+06	2.961E+02
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.51E+04	6.50E-04	3.138E+07	2.040E+04	0.000E+00	0.000E+00	8.359E+03	3.592E-04	3.138E+07	1.127E+04
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.38E+02	5.94E-06	3.190E+07	1.894E+02	0.000E+00	0.000E+00	7.634E+01	3.281E-06	3.190E+07	1.047E+02
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.82E+02	2.07E-05	2.866E+07	5.942E+02	0.000E+00	0.000E+00	2.666E+02	1.145E-05	2.866E+07	3.283E+02
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	6.47E+00	2.78E-07	1.016E+06	2.823E-01	2.440E+07	7.166E+02	3.572E+00	1.535E-07	1.016E+06	1.560E-01
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.23E-01	9.57E-09	1.553E+06	1.486E-02	2.900E+05	2.933E-01	1.230E-01	5.287E-09	1.553E+06	8.211E-03
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	2.21E+00	9.51E-08	1.565E+06	1.488E-01	5.770E+06	5.798E+01	1.222E+00	5.253E-08	1.565E+06	8.221E-02
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.33E-01	5.70E-09	1.604E+06	9.140E-03	7.600E+04	4.577E-02	7.326E-02	3.148E-09	1.604E+06	5.050E-03
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	8.28E-01	3.56E-08	1.419E+06	5.048E-02	1.190E+06	4.474E+00	4.574E-01	1.966E-08	1.419E+06	2.789E-02
	1.54E+04			4.31E+02				1.431E+05		7.793E+02		5.228E-03		7.905E+04

TEDE	cpm	Child Thyroid	cpm
100	1.43E+07	500	3.95E+07
50	7.15E+06	250	1.98E+07
1000	1.43E+08	5000	3.95E+08

Monitor efficiencies from ERS-SFL-85-031
SPING VS-110 Channel 7

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 1.31E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 5.75E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.64E+02	1.14E-05	2.07E+01	2.36E-04	0.00E+00	0.00E+00	1.16E+01	4.99E-07	2.07E+01	1.04E-05
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	6.49E+02	2.79E-05	1.26E+03	3.50E-02	0.00E+00	0.00E+00	2.85E+01	1.22E-06	1.26E+03	1.54E-03
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.73E+03	1.60E-04	2.19E+01	3.51E-03	0.00E+00	0.00E+00	1.64E+02	7.04E-06	2.19E+01	1.54E-04
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.48E+02	1.07E-05	6.32E+03	6.74E-02	0.00E+00	0.00E+00	1.09E+01	4.68E-07	6.32E+03	2.96E-03
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	1.05E+03	4.52E-05	1.56E+04	7.04E-01	0.00E+00	0.00E+00	4.62E+01	1.98E-06	1.56E+04	3.09E-02
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	2.20E-01	9.46E-09	1.46E+04	1.38E-04	0.00E+00	0.00E+00	9.67E-03	4.16E-10	1.46E+04	6.08E-06
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	2.13E+03	9.16E-05	1.60E+02	1.47E-02	0.00E+00	0.00E+00	9.36E+01	4.02E-06	1.60E+02	6.45E-04
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.86E+03	7.98E-05	3.31E+02	2.64E-02	0.00E+00	0.00E+00	8.16E+01	3.51E-06	3.31E+02	1.16E-03
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	1.09E+05	4.69E-03	3.01E+02	1.41E+00	0.00E+00	0.00E+00	4.80E+03	2.06E-04	3.01E+02	6.21E-02
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.64E+03	1.56E-04	3.43E+03	5.37E-01	0.00E+00	0.00E+00	1.60E+02	6.87E-06	3.43E+03	2.36E-02
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.95E+03	3.42E-04	1.98E+03	6.75E-01	0.00E+00	0.00E+00	3.49E+02	1.50E-05	1.98E+03	2.97E-02
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	7.48E-01	3.22E-08	1.50E+03	4.81E-05	0.00E+00	0.00E+00	3.29E-02	1.41E-09	1.50E+03	2.11E-06
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.29E+01	9.84E-07	8.97E+03	8.83E-03	0.00E+00	0.00E+00	1.01E+00	4.32E-08	8.97E+03	3.88E-04
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	8.01E+01	3.44E-06	1.52E+02	5.23E-04	2.44E+07	1.49E+04	3.52E+00	1.51E-07	1.52E+02	2.30E-05
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.87E+01	1.66E-06	9.13E+02	1.52E-03	2.90E+05	8.58E+01	1.70E+00	7.32E-08	9.13E+02	6.68E-05
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	3.11E+01	1.34E-06	2.42E+02	3.23E-04	5.77E+06	1.37E+03	1.37E+00	5.87E-08	2.42E+02	1.42E-05
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.91E+00	8.21E-08	1.05E+03	8.59E-05	7.60E+04	1.11E+00	8.39E-02	3.61E-09	1.05E+03	3.77E-06
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	9.92E+00	4.26E-07	6.28E+02	2.68E-04	1.19E+06	9.02E+01	4.36E-01	1.87E-08	6.28E+02	1.18E-05
	4.46E+04			7.24E+02				3.49E+00		1.65E+04		2.47E-04		1.53E-01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	3.49E+02	5.00E+02	7.66E+01
5.00E+01	1.74E+02	2.50E+02	3.83E+01
1.00E+03	3.49E+03	5.00E+03	7.66E+02

Monitor efficiencies from ERS-SFL-85-031
SPING VS-110 Channel 7

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 1.51E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 8.58E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	3.10E+02	1.33E-05	2.07E+01	2.76E-04	0.00E+00	0.00E+00	1.76E+01	7.56E-07	2.07E+01	1.57E-05
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	7.60E+02	3.27E-05	1.26E+03	4.11E-02	0.00E+00	0.00E+00	4.31E+01	1.85E-06	1.26E+03	2.33E-03
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	2.19E+03	9.40E-05	2.19E+01	2.06E-03	0.00E+00	0.00E+00	1.24E+02	5.33E-06	2.19E+01	1.17E-04
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.91E+02	1.25E-05	6.32E+03	7.91E-02	0.00E+00	0.00E+00	1.65E+01	7.10E-07	6.32E+03	4.49E-03
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.23E+03	5.30E-05	1.56E+04	8.26E-01	0.00E+00	0.00E+00	7.00E+01	3.01E-06	1.56E+04	4.68E-02
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.58E-01	1.11E-08	1.46E+04	1.62E-04	0.00E+00	0.00E+00	1.47E-02	6.30E-10	1.46E+04	9.21E-06
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.50E+03	1.07E-04	1.60E+02	1.72E-02	0.00E+00	0.00E+00	1.42E+02	6.09E-06	1.60E+02	9.76E-04
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	2.19E+03	9.40E-05	3.31E+02	3.11E-02	0.00E+00	0.00E+00	1.24E+02	5.33E-06	3.31E+02	1.76E-03
Xe-133	7.43E+05	8.45E-01	1.76E+02	1.49E+02	1.28E+05	5.50E-03	3.01E+02	1.66E+00	0.00E+00	0.00E+00	7.26E+03	3.12E-04	3.01E+02	9.40E-02
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	4.27E+03	1.84E-04	3.43E+03	6.30E-01	0.00E+00	0.00E+00	2.42E+02	1.04E-05	3.43E+03	3.58E-02
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	9.34E+03	4.01E-04	1.98E+03	7.93E-01	0.00E+00	0.00E+00	5.30E+02	2.28E-05	1.98E+03	4.50E-02
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.64E-03	8.77E-01	3.77E-08	1.50E+03	5.64E-05	0.00E+00	0.00E+00	4.97E-02	2.14E-09	1.50E+03	3.20E-06
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.69E+01	1.16E-06	8.97E+03	1.04E-02	0.00E+00	0.00E+00	1.52E+00	6.55E-08	8.97E+03	5.88E-04
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.88E+01	2.53E-06	1.52E+02	3.84E-04	2.44E+07	9.48E+03	3.33E+00	1.43E-07	1.52E+02	2.18E-05
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.55E+01	1.96E-06	9.13E+02	1.79E-03	2.90E+05	8.72E+01	2.58E+00	1.11E-07	9.13E+02	1.01E-04
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.65E+01	1.57E-06	2.42E+02	3.80E-04	5.77E+06	1.39E+03	2.07E+00	8.90E-08	2.42E+02	2.15E-05
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.24E+00	9.63E-08	1.05E+03	1.01E-04	7.60E+04	1.13E+00	1.27E-01	5.46E-09	1.05E+03	5.71E-06
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.16E+01	5.00E-07	6.28E+02	3.14E-04	1.19E+06	9.15E+01	6.60E-01	2.83E-08	6.28E+02	1.78E-05
	8.78E+05			6.27E+02				4.09E+00		1.10E+04		3.69E-04		2.32E-01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.09E+02	5.00E+02	1.16E+02
5.00E+01	2.05E+02	2.50E+02	5.80E+01
1.00E+03	4.09E+03	5.00E+03	1.16E+03

Monitor efficiencies from ERS-SFL-85-031 — Upstream filtration (iodines reduced 0.01)
SPING VS-110 Channel 7 — Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 7.15E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.95E+04 (Expression 6)

Isotope	U1 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.63E+01	6.99E-07	2.07E+01	1.46E-05	0.00E+00	0.00E+00	8.96E-01	3.86E-08	2.07E+01	8.00E-07
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.71E+01	2.88E-06	1.26E+03	3.62E-03	0.00E+00	0.00E+00	3.71E+00	1.59E-07	1.26E+03	2.00E-04
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.97E+05	1.70E-02	2.19E+01	3.73E-01	0.00E+00	0.00E+00	2.19E+04	9.42E-04	2.19E+01	2.06E-02
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	8.54E+00	3.67E-07	6.32E+03	2.32E-03	0.00E+00	0.00E+00	4.72E-01	2.03E-08	6.32E+03	1.28E-04
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	7.30E+01	3.14E-06	1.56E+04	4.89E-02	0.00E+00	0.00E+00	4.03E+00	1.73E-07	1.56E+04	2.70E-03
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.54E-04	1.52E-11	1.46E+04	2.23E-07	0.00E+00	0.00E+00	1.96E-05	8.41E-13	1.46E+04	1.23E-08
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.43E+04	6.15E-04	1.60E+02	9.85E-02	0.00E+00	0.00E+00	7.91E+02	3.40E-05	1.60E+02	5.44E-03
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	2.20E+03	9.44E-05	3.31E+02	3.12E-02	0.00E+00	0.00E+00	1.21E+02	5.21E-06	3.31E+02	1.72E-03
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	3.01E+05	1.29E-02	3.01E+02	3.89E+00	0.00E+00	0.00E+00	1.66E+04	7.14E-04	3.01E+02	2.15E-01
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.47E+02	6.31E-06	3.43E+03	2.17E-02	0.00E+00	0.00E+00	8.11E+00	3.48E-07	3.43E+03	1.20E-03
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.26E+02	9.70E-06	1.98E+03	1.92E-02	0.00E+00	0.00E+00	1.25E+01	5.36E-07	1.98E+03	1.06E-03
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.44E-03	6.20E-11	1.50E+03	9.28E-08	0.00E+00	0.00E+00	7.97E-05	3.43E-12	1.50E+03	5.13E-09
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.60E-01	6.88E-09	8.97E+03	6.17E-05	0.00E+00	0.00E+00	8.85E-03	3.80E-10	8.97E+03	3.41E-06
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	6.56E+01	2.82E-06	1.52E+02	4.28E-04	2.44E+07	2.24E+03	3.63E+00	1.56E-07	1.52E+02	2.37E-05
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	4.39E+01	1.89E-06	9.13E+02	1.72E-03	2.90E+05	1.78E+01	2.43E+00	1.04E-07	9.13E+02	9.52E-05
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.67E+01	7.19E-07	2.42E+02	1.74E-04	5.77E+06	1.35E+02	9.25E-01	3.97E-08	2.42E+02	9.61E-06
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	4.38E-01	1.88E-08	1.05E+03	1.97E-05	7.60E+04	4.66E-02	2.42E-02	1.04E-09	1.05E+03	1.09E-06
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.56E+00	1.96E-07	6.28E+02	1.23E-04	1.19E+06	7.59E+00	2.52E-01	1.08E-08	6.28E+02	6.80E-06
	5.89E+01			1.33E+02				4.49E+00		2.40E+03		1.70E-03		2.48E-01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.49E+02	5.00E+02	1.24E+02
5.00E+01	2.25E+02	2.50E+02	6.21E+01
1.00E+03	4.49E+03	5.00E+03	1.24E+03

Monitor efficiencies from ERS-SFL-85-031 — Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.005)
SPING VS-110 Channel 7 — Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 2.26E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 4.50E+03 (Expression 5)

Isotope	U1 only LOCA TID (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.96E+02	1.27E-05	2.07E+01	2.63E-04	0.00E+00	0.00E+00	5.88E+01	2.53E-06	2.07E+01	5.24E-05
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	6.10E+02	2.62E-05	1.26E+03	3.29E-02	0.00E+00	0.00E+00	1.21E+02	5.21E-06	1.26E+03	6.55E-03
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.59E+01	1.11E-06	2.19E+01	2.43E-05	0.00E+00	0.00E+00	5.14E+00	2.21E-07	2.19E+01	4.84E-06
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.22E+03	5.25E-05	6.32E+03	3.32E-01	0.00E+00	0.00E+00	2.43E+02	1.04E-05	6.32E+03	6.61E-02
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.70E+03	7.29E-05	1.56E+04	1.14E+00	0.00E+00	0.00E+00	3.38E+02	1.45E-05	1.56E+04	2.26E-01
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	2.11E+03	9.07E-05	1.46E+04	1.33E+00	0.00E+00	0.00E+00	4.20E+02	1.80E-05	1.46E+04	2.64E-01
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.38E+01	1.45E-06	1.60E+02	2.32E-04	0.00E+00	0.00E+00	6.72E+00	2.89E-07	1.60E+02	4.62E-05
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.58E+02	6.78E-06	3.31E+02	2.24E-03	0.00E+00	0.00E+00	3.14E+01	1.35E-06	3.31E+02	4.46E-04
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	5.00E+03	2.15E-04	3.01E+02	6.47E-02	0.00E+00	0.00E+00	9.95E+02	4.28E-05	3.01E+02	1.29E-02
Xe-135m	3.38E+07	4.64E-02	2.15E+03	9.97E+01	1.05E+03	4.51E-05	3.43E+03	1.55E-01	0.00E+00	0.00E+00	2.09E+02	8.98E-06	3.43E+03	3.08E-02
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.51E+03	6.50E-05	1.98E+03	1.28E-01	0.00E+00	0.00E+00	3.01E+02	1.29E-05	1.98E+03	2.56E-02
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.56E+03	1.96E-04	1.50E+03	2.93E-01	0.00E+00	0.00E+00	9.08E+02	3.90E-05	1.50E+03	5.84E-02
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	4.25E+03	1.83E-04	8.97E+03	1.64E+00	0.00E+00	0.00E+00	8.46E+02	3.63E-05	8.97E+03	3.26E-01
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.22E+01	5.23E-07	1.52E+02	7.94E-05	2.44E+07	1.31E+04	2.42E+00	1.04E-07	1.52E+02	1.58E-05
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.78E+01	7.66E-07	9.13E+02	6.99E-04	2.80E+05	2.26E+02	3.54E+00	1.52E-07	9.13E+02	1.39E-04
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.50E+01	1.07E-06	2.42E+02	2.60E-04	5.77E+06	6.37E+03	4.98E+00	2.14E-07	2.42E+02	5.17E-05
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.77E+01	1.19E-06	1.05E+03	1.24E-03	7.60E+04	9.29E+01	5.50E+00	2.37E-07	1.05E+03	2.47E-04
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.38E+01	1.02E-06	6.28E+02	6.41E-04	1.19E+06	1.25E+03	4.73E+00	2.03E-07	6.28E+02	1.28E-04
	7.24E+08			4.19E+03				5.11E+00		2.10E+04		1.94E-04		1.02E+00

TEDE	cpm	Child Thyroid	cpm
1.00E+02	5.11E+02	5.00E+02	5.09E+02
5.00E+01	2.56E+02	2.50E+02	2.54E+02
1.00E+03	5.11E+03	5.00E+03	5.09E+03

Monitor efficiencies from ERS-SFL-85-031
SPING VS-110 Channel 7

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.05E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.05E+04 (Expression 5)

Isotope	U1 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	6.51E+01	2.80E-06	2.07E+01	5.80E-05	0.00E+00	0.00E+00	6.54E+00	2.81E-07	2.07E+01	5.83E-06
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.33E+02	1.00E-05	1.26E+03	1.26E-02	0.00E+00	0.00E+00	2.34E+01	1.01E-06	1.26E+03	1.26E-03
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	2.07E+04	8.88E-04	2.19E+01	1.94E-02	0.00E+00	0.00E+00	2.08E+03	8.92E-05	2.19E+01	1.95E-03
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.47E+02	6.34E-06	6.32E+03	4.01E-02	0.00E+00	0.00E+00	1.48E+01	6.37E-07	6.32E+03	4.03E-03
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	4.29E+02	1.84E-05	1.56E+04	2.87E-01	0.00E+00	0.00E+00	4.31E+01	1.85E-06	1.56E+04	2.89E-02
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.77E+00	1.62E-07	1.46E+04	2.37E-03	0.00E+00	0.00E+00	3.78E-01	1.63E-08	1.46E+04	2.38E-04
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	8.79E+02	3.78E-05	1.60E+02	6.05E-03	0.00E+00	0.00E+00	8.83E+01	3.79E-06	1.60E+02	6.08E-04
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.87E+02	3.38E-05	3.31E+02	1.12E-02	0.00E+00	0.00E+00	7.91E+01	3.40E-06	3.31E+02	1.12E-03
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	5.28E+04	2.27E-03	3.01E+02	6.83E-01	0.00E+00	0.00E+00	5.31E+03	2.28E-04	3.01E+02	6.87E-02
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.33E+04	1.00E-03	3.43E+03	3.44E+00	0.00E+00	0.00E+00	2.34E+03	1.01E-04	3.43E+03	3.46E-01
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	5.23E+03	2.25E-04	1.98E+03	4.44E-01	0.00E+00	0.00E+00	5.26E+02	2.26E-05	1.98E+03	4.46E-02
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.14E+01	4.90E-07	1.50E+03	7.33E-04	0.00E+00	0.00E+00	1.15E+00	4.92E-08	1.50E+03	7.37E-05
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.92E+01	3.40E-06	8.97E+03	3.06E-02	0.00E+00	0.00E+00	7.96E+00	3.42E-07	8.97E+03	3.07E-03
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.59E+01	1.11E-06	1.52E+02	1.69E-04	2.44E+07	6.04E+03	2.61E+00	1.12E-07	1.52E+02	1.70E-05
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.67E+01	1.15E-06	9.13E+02	1.05E-03	2.90E+05	7.38E+01	2.68E+00	1.15E-07	9.13E+02	1.05E-04
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.50E+01	1.93E-06	2.42E+02	4.67E-04	5.77E+06	2.48E+03	4.52E+00	1.94E-07	2.42E+02	4.70E-05
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	3.09E+01	1.33E-06	1.05E+03	1.39E-03	7.60E+04	2.24E+01	3.10E+00	1.33E-07	1.05E+03	1.39E-04
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.43E+01	1.47E-06	6.28E+02	9.24E-04	1.19E+06	3.89E+02	3.44E+00	1.48E-07	6.28E+02	9.29E-05
	4.01E+02			9.05E+02				4.98E+00		9.00E+03		4.53E-04		5.00E-01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.98E+02	5.00E+02	2.50E+02
5.00E+01	2.49E+02	2.50E+02	1.25E+02
1.00E+03	4.98E+03	5.00E+03	2.50E+03

Monitor efficiencies from ERS-SFL-85-031
SPING VS-110 Channel 7

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm • 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 5.24E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.48E+05 (Expression 5)

Isotope	U1 & U2 FHA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	4.69E-01	0.00E+00	0.00E+00	0.00E+00	2.07E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.07E+01	0.00E+00
Kr-85m	1.04E-03	3.07E-08	8.17E+02	2.50E-05	1.61E-02	6.90E-10	1.26E+03	8.67E-07	0.00E+00	0.00E+00	7.61E-03	3.27E-10	1.26E+03	4.11E-07
Kr-85	4.78E+02	1.41E-02	1.12E+01	1.58E-01	7.38E+03	3.17E-04	2.19E+01	6.94E-03	0.00E+00	0.00E+00	3.50E+03	1.50E-04	2.19E+01	3.29E-03
Kr-87	0.00E+00	0.00E+00	4.47E+03	0.00E+00	0.00E+00	0.00E+00	6.32E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.32E+03	0.00E+00
Kr-88	0.00E+00	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	1.56E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E+04	0.00E+00
Kr-89	0.00E+00	0.00E+00	1.02E+04	0.00E+00	0.00E+00	0.00E+00	1.46E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E+04	0.00E+00
Xe-131m	4.66E+02	1.37E-02	4.29E+01	5.89E-01	7.19E+03	3.09E-04	1.60E+02	4.95E-02	0.00E+00	0.00E+00	3.41E+03	1.47E-04	1.60E+02	2.35E-02
Xe-133m	6.16E+02	1.82E-02	1.49E+02	2.71E+00	9.51E+03	4.09E-04	3.31E+02	1.35E-01	0.00E+00	0.00E+00	4.51E+03	1.94E-04	3.31E+02	6.41E-02
Xe-133	3.23E+04	9.52E-01	1.76E+02	1.68E+02	4.99E+05	2.14E-02	3.01E+02	6.45E+00	0.00E+00	0.00E+00	2.36E+05	1.02E-02	3.01E+02	3.06E+00
Xe-135m	2.65E+00	7.81E-05	2.15E+03	1.68E-01	4.09E+01	1.76E-06	3.43E+03	6.04E-03	0.00E+00	0.00E+00	1.94E+01	8.33E-07	3.43E+03	2.86E-03
Xe-135	6.10E+01	1.80E-03	1.25E+03	2.25E+00	9.42E+02	4.05E-05	1.98E+03	8.00E-02	0.00E+00	0.00E+00	4.46E+02	1.92E-05	1.98E+03	3.79E-02
Xe-137	0.00E+00	0.00E+00	9.55E+02	0.00E+00	0.00E+00	0.00E+00	1.50E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.50E+03	0.00E+00
Xe-138	0.00E+00	0.00E+00	6.27E+03	0.00E+00	0.00E+00	0.00E+00	8.97E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.97E+03	0.00E+00
I-131	5.20E-01	1.53E-05	4.66E+05	7.14E+00	8.03E+00	3.45E-07	1.52E+02	5.24E-05	2.44E+07	3.74E+02	3.81E+00	1.64E-07	1.52E+02	2.48E-05
I-132	2.52E-01	7.43E-06	4.33E+04	3.22E-01	3.89E+00	1.67E-07	9.13E+02	1.53E-04	2.90E+05	2.15E+00	1.84E+00	7.93E-08	9.13E+02	7.24E-05
I-133	3.35E-02	9.87E-07	1.28E+05	1.26E-01	5.17E-01	2.22E-08	2.42E+02	5.37E-06	5.77E+06	5.70E+00	2.45E-01	1.05E-08	2.42E+02	2.55E-06
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	1.05E+03	0.00E+00	7.60E+04	0.00E+00	0.00E+00	0.00E+00	1.05E+03	0.00E+00
I-135	2.23E-05	6.57E-10	7.10E+04	4.67E-05	3.44E-04	1.48E-11	6.28E+02	9.29E-09	1.19E+06	7.82E-04	1.63E-04	7.01E-12	6.28E+02	4.40E-09
	3.39E+04			1.81E+02				6.73E+00		3.82E+02		1.07E-02		3.19E+00

TEDE	cpm	Child Thyroid	cpm
1.00E+02	6.73E+02	5.00E+02	1.60E+03
5.00E+01	3.36E+02	2.50E+02	7.98E+02
1.00E+03	6.73E+03	5.00E+03	1.60E+04

X/Q = 9.240E-05 s/m³
Release (uCi/s) CF for TEDE = 2.202E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.216E+05 (Expression 5)

Monitor efficiencies from ERS-SFL-85-031
SPING VS-110 Channel 7

Upstream filtration (Iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm 2.327E+07 cc/s

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	5.45E+02	2.34E-05	2.073E+01	4.857E-04	0.000E+00	0.000E+00	3.012E+02	1.295E-05	2.073E+01	2.684E-04
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.30E+03	5.59E-05	1.257E+03	7.031E-02	0.000E+00	0.000E+00	7.192E+02	3.091E-05	1.257E+03	3.885E-02
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	3.17E+03	1.36E-04	2.190E+01	2.982E-03	0.000E+00	0.000E+00	1.751E+03	7.524E-05	2.190E+01	1.648E-03
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	7.45E+02	3.20E-05	6.322E+03	2.024E-01	0.000E+00	0.000E+00	4.117E+02	1.769E-05	6.322E+03	1.118E-01
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.33E+03	1.00E-04	1.558E+04	1.658E+00	0.000E+00	0.000E+00	1.285E+03	5.524E-05	1.558E+04	8.607E-01
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	5.37E+01	2.31E-06	1.462E+04	3.372E-02	0.000E+00	0.000E+00	2.965E+01	1.274E-06	1.462E+04	1.863E-02
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.65E+03	1.14E-04	1.602E+02	1.828E-02	0.000E+00	0.000E+00	1.467E+03	6.304E-05	1.602E+02	1.010E-02
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	3.18E+03	1.37E-04	3.308E+02	4.525E-02	0.000E+00	0.000E+00	1.759E+03	7.558E-05	3.308E+02	2.500E-02
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.88E+05	8.10E-03	3.011E+02	2.438E+00	0.000E+00	0.000E+00	1.041E+05	4.474E-03	3.011E+02	1.347E+00
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	2.03E+03	8.71E-05	3.433E+03	2.990E-01	0.000E+00	0.000E+00	1.120E+03	4.812E-05	3.433E+03	1.652E-01
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.51E+04	6.50E-04	1.976E+03	1.285E+00	0.000E+00	0.000E+00	8.359E+03	3.592E-04	1.976E+03	7.098E-01
Xe-137	9.68E+00	6.28E-04	9.56E+02	5.99E-01	1.38E+02	5.94E-06	1.496E+03	8.882E-03	0.000E+00	0.000E+00	7.634E+01	3.281E-06	1.496E+03	4.908E-03
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.82E+02	2.07E-05	8.974E+03	1.860E-01	0.000E+00	0.000E+00	2.666E+02	1.145E-05	8.974E+03	1.028E-01
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	6.47E+00	2.78E-07	1.519E+02	4.221E-05	2.440E+07	7.166E+02	3.572E+00	1.535E-07	1.519E+02	2.332E-05
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.23E-01	9.57E-09	9.132E+02	8.738E-06	2.900E+05	2.933E-01	1.230E-01	5.287E-09	9.132E+02	4.828E-06
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	2.21E+00	9.51E-08	2.418E+02	2.299E-05	5.770E+06	5.798E+01	1.222E+00	5.253E-08	2.418E+02	1.270E-05
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.33E-01	5.70E-09	1.046E+03	5.960E-06	7.600E+04	4.577E-02	7.326E-02	3.148E-09	1.046E+03	3.293E-06
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	8.28E-01	3.56E-08	6.278E+02	2.233E-05	1.190E+06	4.474E+00	4.574E-01	1.966E-08	6.278E+02	1.234E-05
	1.54E+04			4.31E+02				6.148E+00		7.793E+02		5.228E-03		3.397E+00

TEDE	cpm	Child Thyroid	cpm
100	6.15E+02	500	1.70E+03
50	3.07E+02	250	8.49E+02
1000	6.15E+03	5000	1.70E+04

Monitor efficiencies from ERS-SFL-85-031 — Upstream filtration (iodines reduced 0.01)
SPING VS-110 Channel 9 — Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s.

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.31E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 5.75E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.64E+02	1.14E-05	6.15E-01	6.99E-06	0.00E+00	0.00E+00	1.16E+01	4.99E-07	6.15E-01	3.07E-07
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	6.49E+02	2.79E-05	3.73E+01	1.04E-03	0.00E+00	0.00E+00	2.85E+01	1.22E-06	3.73E+01	4.57E-05
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.73E+03	1.60E-04	1.37E+00	2.20E-04	0.00E+00	0.00E+00	1.64E+02	7.04E-06	1.37E+00	9.66E-06
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.48E+02	1.07E-05	1.88E+02	2.00E-03	0.00E+00	0.00E+00	1.09E+01	4.68E-07	1.88E+02	8.79E-05
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	1.05E+03	4.52E-05	4.63E+02	2.09E-02	0.00E+00	0.00E+00	4.62E+01	1.98E-06	4.63E+02	9.18E-04
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	2.20E-01	9.46E-09	4.34E+02	4.11E-06	0.00E+00	0.00E+00	9.67E-03	4.16E-10	4.34E+02	1.80E-07
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	2.13E+03	9.16E-05	4.76E+00	4.36E-04	0.00E+00	0.00E+00	9.36E+01	4.02E-06	4.76E+00	1.91E-05
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.86E+03	7.98E-05	9.82E+00	7.84E-04	0.00E+00	0.00E+00	8.16E+01	3.51E-06	9.82E+00	3.45E-05
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	1.09E+05	4.69E-03	4.87E+00	2.29E-02	0.00E+00	0.00E+00	4.80E+03	2.06E-04	4.87E+00	1.00E-03
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.64E+03	1.56E-04	1.02E+02	1.59E-02	0.00E+00	0.00E+00	1.60E+02	6.87E-06	1.02E+02	7.00E-04
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.95E+03	3.42E-04	5.87E+01	2.01E-02	0.00E+00	0.00E+00	3.49E+02	1.50E-05	5.87E+01	8.81E-04
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	7.48E-01	3.22E-08	4.44E+01	1.43E-06	0.00E+00	0.00E+00	3.29E-02	1.41E-09	4.44E+01	6.28E-08
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.29E+01	9.84E-07	2.66E+02	2.62E-04	0.00E+00	0.00E+00	1.01E+00	4.32E-08	2.66E+02	1.15E-05
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	8.01E+01	3.44E-06	4.51E+00	1.55E-05	2.44E+07	1.49E+04	3.52E+00	1.51E-07	4.51E+00	6.82E-07
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.87E+01	1.66E-06	2.71E+01	4.51E-05	2.90E+05	8.58E+01	1.70E+00	7.32E-08	2.71E+01	1.98E-06
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	3.11E+01	1.34E-06	7.18E+00	9.60E-06	5.77E+06	1.37E+03	1.37E+00	5.87E-08	7.18E+00	4.22E-07
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.91E+00	8.21E-08	3.11E+01	2.55E-06	7.60E+04	1.11E+00	8.39E-02	3.61E-09	3.11E+01	1.12E-07
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	9.92E+00	4.26E-07	1.86E+01	7.95E-06	1.19E+06	9.02E+01	4.36E-01	1.87E-08	1.86E+01	3.49E-07
	4.46E+04			7.24E+02				8.46E-02		1.65E+04		2.47E-04		3.72E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	8.46E+00	5.00E+02	1.86E+00
5.00E+01	4.23E+00	2.50E+02	9.29E-01
1.00E+03	8.46E+01	5.00E+03	1.86E+01

Monitor efficiencies from ERS-SFL-85-031 — Upstream filtration (iodines reduced 0.01)
SPING VS-110 Channel 9 — Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.51E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 8.56E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.60E+03	2.05E-03	4.69E-01	9.61E-04	3.10E+02	1.33E-05	6.15E-01	8.20E-06	0.00E+00	0.00E+00	1.76E+01	7.56E-07	6.15E-01	4.65E-07
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	7.60E+02	3.27E-05	3.73E+01	1.22E-03	0.00E+00	0.00E+00	4.31E+01	1.85E-06	3.73E+01	6.91E-05
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	2.19E+03	9.40E-05	1.37E+00	1.29E-04	0.00E+00	0.00E+00	1.24E+02	5.33E-06	1.37E+00	7.32E-06
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.91E+02	1.25E-05	1.88E+02	2.35E-03	0.00E+00	0.00E+00	1.65E+01	7.10E-07	1.88E+02	1.33E-04
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.23E+03	5.30E-05	4.63E+02	2.45E-02	0.00E+00	0.00E+00	7.00E+01	3.01E-06	4.63E+02	1.39E-03
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.58E-01	1.11E-08	4.34E+02	4.82E-06	0.00E+00	0.00E+00	1.47E-02	6.30E-10	4.34E+02	2.73E-07
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.50E+03	1.07E-04	4.76E+00	5.11E-04	0.00E+00	0.00E+00	1.42E+02	6.09E-06	4.76E+00	2.90E-05
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	2.19E+03	9.40E-05	9.82E+00	9.24E-04	0.00E+00	0.00E+00	1.24E+02	5.33E-06	9.82E+00	5.24E-05
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.28E+05	5.50E-03	4.87E+00	2.68E-02	0.00E+00	0.00E+00	7.26E+03	3.12E-04	4.87E+00	1.52E-03
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	4.27E+03	1.84E-04	1.02E+02	1.87E-02	0.00E+00	0.00E+00	2.42E+02	1.04E-05	1.02E+02	1.06E-03
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	9.34E+03	4.01E-04	5.87E+01	2.35E-02	0.00E+00	0.00E+00	5.30E+02	2.28E-05	5.87E+01	1.34E-03
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	8.77E-01	3.77E-08	4.44E+01	1.67E-06	0.00E+00	0.00E+00	4.97E-02	2.14E-09	4.44E+01	9.50E-08
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.69E+01	1.16E-06	2.66E+02	3.08E-04	0.00E+00	0.00E+00	1.52E+00	6.55E-08	2.66E+02	1.75E-05
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.88E+01	2.53E-06	4.51E+00	1.14E-05	2.44E+07	9.48E+03	3.33E+00	1.43E-07	4.51E+00	8.46E-07
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.55E+01	1.96E-06	2.71E+01	5.30E-05	2.90E+05	8.72E+01	2.58E+00	1.11E-07	2.71E+01	3.01E-06
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.65E+01	1.57E-06	7.18E+00	1.13E-05	5.77E+06	1.39E+03	2.07E+00	8.90E-08	7.18E+00	6.39E-07
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.24E+00	9.63E-08	3.11E+01	2.98E-06	7.60E+04	1.13E+00	1.27E-01	5.46E-09	3.11E+01	1.70E-07
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.16E+01	5.00E-07	1.86E+01	9.32E-06	1.19E+06	9.15E+01	6.60E-01	2.83E-08	1.86E+01	5.28E-07
	8.78E+05			6.27E+02				9.91E-02		1.10E+04		3.69E-04		5.62E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	9.91E+00	5.00E+02	2.81E+00
5.00E+01	4.96E+00	2.50E+02	1.41E+00
1.00E+03	9.91E+01	5.00E+03	2.81E+01

Monitor efficiencies from ERS-SFL-85-031
SPING VS-110 Channel 9

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 7.15E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.95E+04 (Expression 5)

Isotope	U1 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.63E+01	6.99E-07	6.15E-01	4.30E-07	0.00E+00	0.00E+00	8.98E-01	3.86E-08	6.15E-01	2.37E-08
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.71E+01	2.88E-06	3.73E+01	1.08E-04	0.00E+00	0.00E+00	3.71E+00	1.59E-07	3.73E+01	5.94E-06
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.97E+05	1.70E-02	1.37E+00	2.34E-02	0.00E+00	0.00E+00	2.19E+04	9.42E-04	1.37E+00	1.29E-03
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	8.54E+00	3.67E-07	1.88E+02	6.89E-05	0.00E+00	0.00E+00	4.72E-01	2.03E-08	1.88E+02	3.81E-06
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	7.30E+01	3.14E-06	4.63E+02	1.45E-03	0.00E+00	0.00E+00	4.03E+00	1.73E-07	4.63E+02	8.02E-05
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.54E-04	1.52E-11	4.34E+02	6.61E-09	0.00E+00	0.00E+00	1.96E-05	8.41E-13	4.34E+02	3.65E-10
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.43E+04	6.15E-04	4.76E+00	2.93E-03	0.00E+00	0.00E+00	7.91E+02	3.40E-05	4.76E+00	1.62E-04
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	2.20E+03	9.44E-05	9.82E+00	9.27E-04	0.00E+00	0.00E+00	1.21E+02	5.21E-06	9.82E+00	5.12E-05
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	3.01E+05	1.29E-02	4.87E+00	6.30E-02	0.00E+00	0.00E+00	1.66E+04	7.14E-04	4.87E+00	3.48E-03
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.47E+02	6.31E-06	1.02E+02	6.43E-04	0.00E+00	0.00E+00	8.11E+00	3.48E-07	1.02E+02	3.55E-05
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.26E+02	9.70E-06	5.87E+01	5.69E-04	0.00E+00	0.00E+00	1.25E+01	5.36E-07	5.87E+01	3.14E-05
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.44E-03	6.20E-11	4.44E+01	2.76E-09	0.00E+00	0.00E+00	7.97E-05	3.43E-12	4.44E+01	1.52E-10
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.60E-01	6.88E-09	2.66E+02	1.83E-06	0.00E+00	0.00E+00	8.85E-03	3.80E-10	2.66E+02	1.01E-07
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	6.66E+01	2.82E-06	4.51E+00	1.27E-05	2.44E+07	2.24E+03	3.63E+00	1.56E-07	4.51E+00	7.03E-07
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	4.39E+01	1.89E-06	2.71E+01	5.12E-05	2.90E+05	1.78E+01	2.43E+00	1.04E-07	2.71E+01	2.83E-06
I-133	1.38E-03	2.34E-05	1.28E+06	3.00E+00	1.67E+01	7.19E-07	7.18E+00	5.16E-06	5.77E+06	1.35E+02	9.25E-01	3.97E-08	7.18E+00	2.85E-07
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	4.38E-01	1.88E-08	3.11E+01	5.84E-07	7.60E+04	4.68E-02	2.42E-02	1.04E-09	3.11E+01	3.23E-08
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.56E+00	1.96E-07	1.86E+01	3.65E-06	1.19E+06	7.59E+00	2.52E-01	1.08E-08	1.86E+01	2.02E-07
	5.89E+01			1.33E+02				9.31E-02		2.40E+03		1.70E-03		5.15E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	9.31E+00	5.00E+02	2.57E+00
5.00E+01	4.66E+00	2.50E+02	1.29E+00
1.00E+03	9.31E+01	5.00E+03	2.57E+01

Monitor efficiencies from ERS-SFL-85-031
SPING VS-110 Channel 9

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.005)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 2.26E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 4.50E+03 (Expression 5)

Isotope	U1 only LOCA TID (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.96E+02	1.27E-05	6.15E-01	7.82E-06	0.00E+00	0.00E+00	5.88E+01	2.53E-06	6.15E-01	1.56E-06
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	6.10E+02	2.62E-05	3.73E+01	9.78E-04	0.00E+00	0.00E+00	1.21E+02	5.21E-06	3.73E+01	1.94E-04
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.59E+01	1.11E-06	1.37E+00	1.52E-06	0.00E+00	0.00E+00	5.14E+00	2.21E-07	1.37E+00	3.03E-07
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.22E+03	5.25E-05	1.88E+02	9.86E-03	0.00E+00	0.00E+00	2.43E+02	1.04E-05	1.88E+02	1.96E-03
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.70E+03	7.29E-05	4.63E+02	3.37E-02	0.00E+00	0.00E+00	3.38E+02	1.45E-05	4.63E+02	6.71E-03
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	2.11E+03	9.07E-05	4.34E+02	3.94E-02	0.00E+00	0.00E+00	4.20E+02	1.80E-05	4.34E+02	7.83E-03
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.38E+01	1.45E-06	4.76E+00	6.90E-06	0.00E+00	0.00E+00	6.72E+00	2.89E-07	4.76E+00	1.37E-06
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.58E+02	6.78E-06	9.82E+00	6.66E-05	0.00E+00	0.00E+00	3.14E+01	1.35E-06	9.82E+00	1.33E-05
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	5.00E+03	2.15E-04	4.87E+00	1.05E-03	0.00E+00	0.00E+00	9.95E+02	4.28E-05	4.87E+00	2.08E-04
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	1.05E+03	4.51E-05	1.02E+02	4.60E-03	0.00E+00	0.00E+00	2.09E+02	8.98E-06	1.02E+02	9.15E-04
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.51E+03	6.50E-05	5.87E+01	3.81E-03	0.00E+00	0.00E+00	3.01E+02	1.29E-05	5.87E+01	7.59E-04
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.83E+02	4.56E+03	1.96E-04	4.44E+01	8.71E-03	0.00E+00	0.00E+00	9.08E+02	3.90E-05	4.44E+01	1.73E-03
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	4.25E+03	1.83E-04	2.66E+02	4.87E-02	0.00E+00	0.00E+00	8.46E+02	3.63E-05	2.66E+02	9.68E-03
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.22E+01	5.23E-07	4.51E+00	2.36E-06	2.44E+07	1.31E+04	2.42E+00	1.04E-07	4.51E+00	4.69E-07
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.78E+01	7.66E-07	2.71E+01	2.08E-05	2.90E+05	2.28E+02	3.54E+00	1.52E-07	2.71E+01	4.13E-06
I-133	8.00E+05	1.10E-03	1.28E+06	1.41E+02	2.50E+01	1.07E-06	7.18E+00	7.72E-06	5.77E+06	6.37E+03	4.98E+00	2.14E-07	7.18E+00	1.53E-06
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.77E+01	1.19E-06	3.11E+01	3.69E-05	7.60E+04	9.29E+01	5.50E+00	2.37E-07	3.11E+01	7.35E-06
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.38E+01	1.02E-06	1.86E+01	1.90E-05	1.19E+06	1.25E+03	4.73E+00	2.03E-07	1.86E+01	3.79E-06
	7.24E+08			4.19E+03				1.51E-01		2.10E+04		1.94E-04		3.00E-02

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.51E+01	5.00E+02	1.50E+01
5.00E+01	7.55E+00	2.50E+02	7.51E+00
1.00E+03	1.51E+02	5.00E+03	1.50E+02

Monitor efficiencies from ERS-SFL-85-031
SPING VS-110 Channel 9

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.05E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.05E+04 (Expression 5)

Isotope	U1 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	6.51E+01	2.80E-06	6.15E-01	1.72E-06	0.00E+00	0.00E+00	6.54E+00	2.81E-07	6.15E-01	1.73E-07
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.33E+02	1.00E-05	3.73E+01	3.73E-04	0.00E+00	0.00E+00	2.34E+01	1.01E-06	3.73E+01	3.75E-05
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	2.07E+04	8.88E-04	1.37E+00	1.22E-03	0.00E+00	0.00E+00	2.08E+03	8.92E-05	1.37E+00	1.22E-04
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.47E+02	6.34E-06	1.88E+02	1.19E-03	0.00E+00	0.00E+00	1.48E+01	6.37E-07	1.88E+02	1.20E-04
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	4.29E+02	1.84E-05	4.63E+02	8.52E-03	0.00E+00	0.00E+00	4.31E+01	1.85E-06	4.63E+02	8.57E-04
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.77E+00	1.62E-07	4.34E+02	7.02E-05	0.00E+00	0.00E+00	3.78E-01	1.63E-08	4.34E+02	7.06E-06
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	8.79E+02	3.78E-05	4.76E+00	1.80E-04	0.00E+00	0.00E+00	8.83E+01	3.79E-06	4.76E+00	1.81E-05
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.87E+02	3.38E-05	9.82E+00	3.32E-04	0.00E+00	0.00E+00	7.91E+01	3.40E-06	9.82E+00	3.34E-05
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	5.28E+04	2.27E-03	4.87E+00	1.11E-02	0.00E+00	0.00E+00	5.31E+03	2.28E-04	4.87E+00	1.11E-03
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.33E+04	1.00E-03	1.02E+02	1.02E-01	0.00E+00	0.00E+00	2.34E+03	1.01E-04	1.02E+02	1.03E-02
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	5.23E+03	2.25E-04	5.87E+01	1.32E-02	0.00E+00	0.00E+00	5.26E+02	2.26E-05	5.87E+01	1.33E-03
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.14E+01	4.90E-07	4.44E+01	2.18E-05	0.00E+00	0.00E+00	1.15E+00	4.92E-08	4.44E+01	2.19E-06
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.92E+01	3.40E-06	2.66E+02	9.07E-04	0.00E+00	0.00E+00	7.96E+00	3.42E-07	2.66E+02	9.12E-05
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.59E+01	1.11E-06	4.51E+00	5.03E-06	2.44E+07	6.04E+03	2.61E+00	1.12E-07	4.51E+00	5.05E-07
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.67E+01	1.15E-06	2.71E+01	3.11E-05	2.90E+05	7.38E+01	2.68E+00	1.16E-07	2.71E+01	3.12E-06
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.50E+01	1.93E-06	7.18E+00	1.39E-05	5.77E+06	2.48E+03	4.52E+00	1.94E-07	7.18E+00	1.39E-06
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	3.09E+01	1.33E-06	3.11E+01	4.12E-05	7.60E+04	2.24E+01	3.10E+00	1.33E-07	3.11E+01	4.14E-06
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.43E+01	1.47E-06	1.86E+01	2.74E-05	1.19E+06	3.89E+02	3.44E+00	1.48E-07	1.86E+01	2.76E-06
	4.01E+02			9.05E+02				1.39E-01		9.00E+03		4.53E-04		1.40E-02

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.39E+01	5.00E+02	7.00E+00
5.00E+01	6.96E+00	2.50E+02	3.50E+00
1.00E+03	1.39E+02	5.00E+03	7.00E+01

Monitor efficiencies from ERS-SFL-85-031
SPING VS-110 Channel 9

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 5.24E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.48E+05 (Expression 5)

Isotope	U1 & U2 FHA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	4.69E-01	0.00E+00	0.00E+00	0.00E+00	6.15E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.15E-01	0.00E+00
Kr-85m	1.04E-03	3.07E-08	8.17E+02	2.50E-05	1.61E-02	6.90E-10	3.73E+01	2.57E-08	0.00E+00	0.00E+00	7.61E-03	3.27E-10	3.73E+01	1.22E-08
Kr-85	4.78E+02	1.41E-02	1.12E+01	1.58E-01	7.38E+03	3.17E-04	1.37E+00	4.35E-04	0.00E+00	0.00E+00	3.50E+03	1.50E-04	1.37E+00	2.06E-04
Kr-87	0.00E+00	0.00E+00	4.47E+03	0.00E+00	0.00E+00	0.00E+00	1.88E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.88E+02	0.00E+00
Kr-88	0.00E+00	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	4.63E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.63E+02	0.00E+00
Kr-89	0.00E+00	0.00E+00	1.02E+04	0.00E+00	0.00E+00	0.00E+00	4.34E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.34E+02	0.00E+00
Xe-131m	4.66E+02	1.37E-02	4.29E+01	5.89E-01	7.19E+03	3.09E-04	4.76E+00	1.47E-03	0.00E+00	0.00E+00	3.41E+03	1.47E-04	4.76E+00	6.97E-04
Xe-133m	6.16E+02	1.82E-02	1.49E+02	2.71E+00	9.51E+03	4.09E-04	9.82E+00	4.01E-03	0.00E+00	0.00E+00	4.51E+03	1.94E-04	9.82E+00	1.90E-03
Xe-133	3.23E+04	9.52E-01	1.76E+02	1.68E+02	4.99E+05	2.14E-02	4.87E+00	1.04E-01	0.00E+00	0.00E+00	2.36E+05	1.02E-02	4.87E+00	4.95E-02
Xe-135m	2.65E+00	7.81E-05	2.15E+03	1.68E-01	4.09E+01	1.76E-06	1.02E+02	1.79E-04	0.00E+00	0.00E+00	1.94E+01	8.33E-07	1.02E+02	8.49E-05
Xe-135	6.10E+01	1.80E-03	1.25E+03	2.25E+00	9.42E+02	4.05E-05	5.87E+01	2.37E-03	0.00E+00	0.00E+00	4.46E+02	1.92E-05	5.87E+01	1.13E-03
Xe-137	0.00E+00	0.00E+00	9.55E+02	0.00E+00	0.00E+00	0.00E+00	4.44E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.44E+01	0.00E+00
Xe-138	0.00E+00	0.00E+00	6.27E+03	0.00E+00	0.00E+00	0.00E+00	2.66E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.66E+02	0.00E+00
I-131	5.20E-01	1.53E-05	4.66E+05	7.14E+00	8.03E+00	3.45E-07	4.51E+00	1.56E-06	2.44E+07	3.74E+02	3.81E+00	1.64E-07	4.51E+00	7.37E-07
I-132	2.52E-01	7.43E-06	4.33E+04	3.22E-01	3.89E+00	1.67E-07	2.71E+01	4.53E-06	2.90E+05	2.15E+00	1.84E+00	7.93E-08	2.71E+01	2.15E-06
I-133	3.35E-02	9.87E-07	1.28E+05	1.26E-01	5.17E-01	2.22E-08	7.18E+00	1.60E-07	5.77E+06	5.70E+00	2.45E-01	1.05E-08	7.18E+00	7.56E-08
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	3.11E+01	0.00E+00	7.60E+04	0.00E+00	0.00E+00	0.00E+00	3.11E+01	0.00E+00
I-135	2.23E-05	6.57E-10	7.10E+04	4.67E-05	3.44E-04	1.48E-11	1.86E+01	2.76E-10	1.19E+06	7.82E-04	1.63E-04	7.01E-12	1.86E+01	1.31E-10
	3.39E+04			1.81E+02				1.13E-01		3.82E+02		1.07E-02		5.35E-02

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.13E+01	5.00E+02	2.68E+01
5.00E+01	5.64E+00	2.50E+02	1.34E+01
1.00E+03	1.13E+02	5.00E+03	2.68E+02

Monitor efficiencies from ERS-SFL-85-031
SPING VS-110 Channel 9

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.327E+07 cc/s

X/Q = 9.240E-05 s/m^3
Release (uCi/s) CF for TEDE = 2.202E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.216E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	5.45E+02	2.34E-05	6.153E-01	1.442E-05	0.000E+00	0.000E+00	3.012E+02	1.295E-05	6.153E-01	7.966E-06
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.30E+03	5.59E-05	3.732E+01	2.088E-03	0.000E+00	0.000E+00	7.192E+02	3.091E-05	3.732E+01	1.153E-03
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	3.17E+03	1.36E-04	1.372E+00	1.868E-04	0.000E+00	0.000E+00	1.751E+03	7.524E-05	1.372E+00	1.032E-04
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	7.45E+02	3.20E-05	1.877E+02	6.010E-03	0.000E+00	0.000E+00	4.117E+02	1.769E-05	1.877E+02	3.321E-03
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.33E+03	1.00E-04	4.626E+02	4.625E-02	0.000E+00	0.000E+00	1.285E+03	5.524E-05	4.626E+02	2.555E-02
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	5.37E+01	2.31E-06	4.341E+02	1.001E-03	0.000E+00	0.000E+00	2.965E+01	1.274E-06	4.341E+02	5.532E-04
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.65E+03	1.14E-04	4.757E+00	5.427E-04	0.000E+00	0.000E+00	1.467E+03	6.304E-05	4.757E+00	2.999E-04
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	3.18E+03	1.37E-04	9.821E+00	1.343E-03	0.000E+00	0.000E+00	1.759E+03	7.558E-05	9.821E+00	7.422E-04
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.88E+05	8.10E-03	4.872E+00	3.945E-02	0.000E+00	0.000E+00	1.041E+05	4.474E-03	4.872E+00	2.179E-02
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	2.03E+03	8.71E-05	1.019E+02	8.875E-03	0.000E+00	0.000E+00	1.120E+03	4.812E-05	1.019E+02	4.904E-03
Xe-135	1.06E+03	6.87E-02	1.26E+03	8.59E+01	1.51E+04	6.50E-04	5.867E+01	3.814E-02	0.000E+00	0.000E+00	8.359E+03	3.592E-04	5.867E+01	2.108E-02
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.38E+02	5.94E-06	4.442E+01	2.637E-04	0.000E+00	0.000E+00	7.634E+01	3.281E-06	4.442E+01	1.457E-04
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.82E+02	2.07E-05	2.664E+02	5.523E-03	0.000E+00	0.000E+00	2.666E+02	1.145E-05	2.664E+02	3.052E-03
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	6.47E+00	2.78E-07	4.509E+00	1.253E-06	2.440E+07	7.166E+02	3.572E+00	1.535E-07	4.509E+00	6.922E-07
I-132	1.66E-02	1.01E-06	4.33E+04	4.38E-02	2.23E-01	9.57E-09	2.711E+01	2.694E-07	2.900E+05	2.933E-01	1.230E-01	5.287E-09	2.711E+01	1.433E-07
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	2.21E+00	9.51E-08	7.179E+00	6.825E-07	5.770E+06	5.798E+01	1.222E+00	5.253E-08	7.179E+00	3.771E-07
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.33E-01	5.70E-09	3.106E+01	1.770E-07	7.600E+04	4.577E-02	7.326E-02	3.148E-09	3.106E+01	9.778E-08
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	8.28E-01	3.56E-08	1.864E+01	6.631E-07	1.190E+06	4.474E+00	4.574E-01	1.966E-08	1.864E+01	3.664E-07
	1.54E+04			4.31E+02				1.497E-01		7.793E+02		5.228E-03		8.271E-02

TEDE	cpm	Child Thyroid	cpm
100	1.50E+01	500	4.14E+01
50	7.48E+00	250	2.07E+01
1000	1.50E+02	5000	4.14E+02

Monitor efficiencies from ERS-SFL-85-031
VS-112 LR SA10

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.31E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 5.75E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.64E+02	1.14E-05	3.12E+03	3.54E-02	0.00E+00	0.00E+00	1.16E+01	4.99E-07	3.12E+03	1.56E-03
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	6.49E+02	2.79E-05	1.89E-05	5.27E-10	0.00E+00	0.00E+00	2.85E+01	1.22E-06	1.89E-05	2.32E-11
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.73E+03	1.60E-04	3.22E+03	5.15E-01	0.00E+00	0.00E+00	1.64E+02	7.04E-06	3.22E+03	2.26E-02
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.48E+02	1.07E-05	9.51E+05	1.01E+01	0.00E+00	0.00E+00	1.09E+01	4.68E-07	9.51E+05	4.45E-01
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	1.05E+03	4.52E-05	2.34E+06	1.06E+02	0.00E+00	0.00E+00	4.62E+01	1.98E-06	2.34E+06	4.65E+00
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	2.20E-01	9.46E-09	2.20E+06	2.08E-02	0.00E+00	0.00E+00	9.67E-03	4.16E-10	2.20E+06	9.14E-04
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	2.13E+03	9.16E-05	2.41E+04	2.21E+00	0.00E+00	0.00E+00	9.36E+01	4.02E-06	2.41E+04	9.70E-02
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.86E+03	7.98E-05	4.98E+04	3.97E+00	0.00E+00	0.00E+00	8.16E+01	3.51E-06	4.98E+04	1.75E-01
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	1.09E+05	4.69E-03	4.00E+04	1.87E+02	0.00E+00	0.00E+00	4.80E+03	2.06E-04	4.00E+04	8.24E+00
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.64E+03	1.56E-04	5.17E+05	8.08E+01	0.00E+00	0.00E+00	1.60E+02	6.87E-06	5.17E+05	3.55E+00
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.95E+03	3.42E-04	2.97E+05	1.02E+02	0.00E+00	0.00E+00	3.49E+02	1.50E-05	2.97E+05	4.46E+00
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	7.48E-01	3.22E-08	2.25E+05	7.24E-03	0.00E+00	0.00E+00	3.29E-02	1.41E-09	2.25E+05	3.18E-04
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.29E+01	9.84E-07	1.35E+06	1.33E+00	0.00E+00	0.00E+00	1.01E+00	4.32E-08	1.35E+06	5.84E-02
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	8.01E+01	3.44E-06	2.29E+04	7.87E-02	2.44E+07	1.49E+04	3.52E+00	1.51E-07	2.29E+04	3.46E-03
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.87E+01	1.66E-06	1.37E+05	2.29E-01	2.90E+05	8.58E+01	1.70E+00	7.32E-08	1.37E+05	1.01E-02
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	3.11E+01	1.34E-06	3.64E+04	4.86E-02	5.77E+06	1.37E+03	1.37E+00	5.87E-08	3.64E+04	2.14E-03
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.91E+00	8.21E-08	1.57E+05	1.29E-02	7.60E+04	1.11E+00	8.39E-02	3.61E-09	1.57E+05	5.68E-04
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	9.92E+00	4.26E-07	9.45E+04	4.03E-02	1.19E+06	9.02E+01	4.36E-01	1.87E-08	9.45E+04	1.77E-03
	4.46E+04			7.24E+02				4.94E+02		1.65E+04		2.47E-04		2.17E+01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	4.94E+04	5.00E+02	1.09E+04
5.00E+01	2.47E+04	2.50E+02	5.43E+03
1.00E+03	4.94E+05	5.00E+03	1.09E+05

Monitor efficiencies from ERS-SFL-85-031
VS-112 LR SA10

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.51E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 8.58E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	3.10E+02	1.33E-05	3.12E+03	4.16E-02	0.00E+00	0.00E+00	1.76E+01	7.56E-07	3.12E+03	2.36E-03
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	7.60E+02	3.27E-05	1.89E-05	6.18E-10	0.00E+00	0.00E+00	4.31E+01	1.85E-06	1.89E-05	3.50E-11
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	2.19E+03	9.40E-05	3.22E+03	3.03E-01	0.00E+00	0.00E+00	1.24E+02	5.33E-06	3.22E+03	1.72E-02
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.91E+02	1.25E-05	9.51E+05	1.19E+01	0.00E+00	0.00E+00	1.65E+01	7.10E-07	9.51E+05	6.75E-01
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.23E+03	5.30E-05	2.34E+06	1.24E+02	0.00E+00	0.00E+00	7.00E+01	3.01E-06	2.34E+06	7.05E+00
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.58E-01	1.11E-08	2.20E+06	2.44E-02	0.00E+00	0.00E+00	1.47E-02	6.30E-10	2.20E+06	1.39E-03
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.50E+03	1.07E-04	2.41E+04	2.59E+00	0.00E+00	0.00E+00	1.42E+02	6.09E-06	2.41E+04	1.47E-01
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	2.19E+03	9.40E-05	4.98E+04	4.68E+00	0.00E+00	0.00E+00	1.24E+02	5.33E-06	4.98E+04	2.65E-01
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.28E+05	5.50E-03	4.00E+04	2.20E+02	0.00E+00	0.00E+00	7.26E+03	3.12E-04	4.00E+04	1.25E+01
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	4.27E+03	1.84E-04	5.17E+05	9.49E+01	0.00E+00	0.00E+00	2.42E+02	1.04E-05	5.17E+05	5.38E+00
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	9.34E+03	4.01E-04	2.97E+05	1.19E+02	0.00E+00	0.00E+00	5.30E+02	2.28E-05	2.97E+05	6.77E+00
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	8.77E-01	3.77E-08	2.25E+05	8.48E-03	0.00E+00	0.00E+00	4.97E-02	2.14E-09	2.25E+05	4.81E-04
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.69E+01	1.16E-06	1.35E+06	1.56E+00	0.00E+00	0.00E+00	1.52E+00	6.55E-08	1.35E+06	8.84E-02
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.88E+01	2.53E-06	2.29E+04	5.77E-02	2.44E+07	9.48E+03	3.33E+00	1.43E-07	2.29E+04	3.27E-03
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.55E+01	1.96E-06	1.37E+05	2.69E-01	2.90E+05	8.72E+01	2.58E+00	1.11E-07	1.37E+05	1.52E-02
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.65E+01	1.57E-06	3.64E+04	5.71E-02	5.77E+06	1.39E+03	2.07E+00	8.90E-08	3.64E+04	3.24E-03
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.24E+00	9.63E-08	1.57E+05	1.52E-02	7.60E+04	1.13E+00	1.27E-01	5.46E-09	1.57E+05	8.59E-04
I-136	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.16E+01	5.00E-07	9.45E+04	4.72E-02	1.19E+06	9.15E+01	6.60E-01	2.83E-08	9.45E+04	2.68E-03
	8.78E+05			6.27E+02				5.80E+02		1.10E+04		3.69E-04		3.29E+01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	5.80E+04	5.00E+02	1.64E+04
5.00E+01	2.90E+04	2.50E+02	8.22E+03
1.00E+03	5.80E+05	5.00E+03	1.64E+05

Monitor efficiencies from ERS-SFL-85-031
VS-112 LR SA10

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm 2.33E+07 cc/s

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 7.15E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.95E+04 (Expression 5)

Isotope	U1 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.63E+01	6.99E-07	3.12E+03	2.18E-03	0.00E+00	0.00E+00	8.98E-01	3.86E-08	3.12E+03	1.20E-04
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.71E+01	2.88E-06	1.89E-05	5.45E-11	0.00E+00	0.00E+00	3.71E+00	1.59E-07	1.89E-05	3.01E-12
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.97E+05	1.70E-02	3.22E+03	5.49E+01	0.00E+00	0.00E+00	2.19E+04	9.42E-04	3.22E+03	3.03E+00
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	8.54E+00	3.67E-07	9.51E+05	3.49E-01	0.00E+00	0.00E+00	4.72E-01	2.03E-08	9.51E+05	1.93E-02
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	7.30E+01	3.14E-06	2.34E+06	7.38E+00	0.00E+00	0.00E+00	4.03E+00	1.73E-07	2.34E+06	4.06E-01
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.54E-04	1.52E-11	2.20E+06	3.35E-05	0.00E+00	0.00E+00	1.96E-05	8.41E-13	2.20E+06	1.85E-06
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.43E+04	6.15E-04	2.41E+04	1.48E+01	0.00E+00	0.00E+00	7.91E+02	3.40E-05	2.41E+04	8.19E-01
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	2.20E+03	9.44E-05	4.98E+04	4.70E+00	0.00E+00	0.00E+00	1.21E+02	5.21E-06	4.98E+04	2.59E-01
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	3.01E+05	1.29E-02	4.00E+04	5.16E+02	0.00E+00	0.00E+00	1.66E+04	7.14E-04	4.00E+04	2.85E+01
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.47E+02	6.31E-06	5.17E+05	3.26E+00	0.00E+00	0.00E+00	8.11E+00	3.48E-07	5.17E+05	1.80E-01
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.26E+02	9.70E-06	2.97E+05	2.88E+00	0.00E+00	0.00E+00	1.25E+01	5.36E-07	2.97E+05	1.59E-01
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.44E-03	6.20E-11	2.25E+05	1.40E-05	0.00E+00	0.00E+00	7.97E-05	3.43E-12	2.25E+05	7.71E-07
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.80E-01	6.88E-09	1.35E+06	9.29E-03	0.00E+00	0.00E+00	8.85E-03	3.80E-10	1.35E+06	5.13E-04
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	6.56E+01	2.82E-06	2.29E+04	6.44E-02	2.44E+07	2.24E+03	3.63E+00	1.56E-07	2.29E+04	3.56E-03
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	4.39E+01	1.89E-06	1.37E+05	2.59E-01	2.90E+05	1.78E+01	2.43E+00	1.04E-07	1.37E+05	1.43E-02
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.67E+01	7.19E-07	3.64E+04	2.62E-02	5.77E+06	1.35E+02	9.25E-01	3.97E-08	3.64E+04	1.45E-03
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	4.38E-01	1.88E-08	1.57E+05	2.96E-03	7.60E+04	4.66E-02	2.42E-02	1.04E-09	1.57E+05	1.64E-04
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.56E+00	1.96E-07	9.45E+04	1.85E-02	1.19E+06	7.59E+00	2.52E-01	1.08E-08	9.45E+04	1.02E-03
	5.89E+01			1.33E+02				6.05E+02		2.40E+03		1.70E-03		3.34E+01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	6.05E+04	5.00E+02	1.67E+04
5.00E+01	3.03E+04	2.50E+02	8.36E+03
1.00E+03	6.05E+05	5.00E+03	1.67E+05

Monitor efficiencies from ERS-SFL-85-031
VS-112 LR SA10

Pre-release iodine mitigation in ERS-MPD-01-002 (iodines reduced 0.005)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 2.26E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 4.50E+03 (Expression 5)

Isotope	U1 only LOCA TID (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.96E+02	1.27E-05	3.12E+03	3.96E-02	0.00E+00	0.00E+00	5.88E+01	2.53E-06	3.12E+03	7.88E-03
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	6.10E+02	2.62E-05	1.89E-05	4.95E-10	0.00E+00	0.00E+00	1.21E+02	5.21E-06	1.89E-05	9.85E-11
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.59E+01	1.11E-06	3.22E+03	3.58E-03	0.00E+00	0.00E+00	5.14E+00	2.21E-07	3.22E+03	7.11E-04
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.22E+03	5.25E-05	9.51E+05	5.00E+01	0.00E+00	0.00E+00	2.43E+02	1.04E-05	9.51E+05	9.94E+00
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.70E+03	7.29E-05	2.34E+06	1.71E+02	0.00E+00	0.00E+00	3.38E+02	1.45E-05	2.34E+06	3.40E+01
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	2.11E+03	9.07E-05	2.20E+06	1.99E+02	0.00E+00	0.00E+00	4.20E+02	1.80E-05	2.20E+06	3.97E+01
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.38E+01	1.45E-06	2.41E+04	3.50E-02	0.00E+00	0.00E+00	6.72E+00	2.89E-07	2.41E+04	6.96E-03
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.58E+02	6.78E-06	4.98E+04	3.38E-01	0.00E+00	0.00E+00	3.14E+01	1.35E-06	4.98E+04	6.72E-02
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	5.00E+03	2.15E-04	4.00E+04	8.59E+00	0.00E+00	0.00E+00	9.95E+02	4.28E-05	4.00E+04	1.71E+00
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	1.05E+03	4.51E-05	5.17E+05	2.33E+01	0.00E+00	0.00E+00	2.09E+02	8.98E-06	5.17E+05	4.64E+00
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.51E+03	6.50E-05	2.97E+05	1.93E+01	0.00E+00	0.00E+00	3.01E+02	1.29E-05	2.97E+05	3.85E+00
Xe-137	1.46E+08	2.02E-01	9.56E+02	1.93E+02	4.56E+03	1.96E-04	2.25E+05	4.41E+01	0.00E+00	0.00E+00	9.08E+02	3.90E-05	2.25E+05	8.78E+00
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	4.25E+03	1.83E-04	1.35E+06	2.47E+02	0.00E+00	0.00E+00	8.46E+02	3.63E-05	1.35E+06	4.91E+01
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.22E+01	5.23E-07	2.29E+04	1.19E-02	2.44E+07	1.31E+04	2.42E+00	1.04E-07	2.29E+04	2.38E-03
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.78E+01	7.66E-07	1.37E+05	1.05E-01	2.90E+05	2.28E+02	3.54E+00	1.52E-07	1.37E+05	2.09E-02
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.50E+01	1.07E-06	3.64E+04	3.81E-02	5.77E+06	6.37E+03	4.98E+00	2.14E-07	3.64E+04	7.78E-03
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.77E+01	1.19E-06	1.57E+05	1.87E-01	7.60E+04	9.29E+01	5.50E+00	2.37E-07	1.57E+05	3.72E-02
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.38E+01	1.02E-06	9.45E+04	9.64E-02	1.19E+06	1.25E+03	4.73E+00	2.03E-07	9.45E+04	1.92E-02
	7.24E+08			4.19E+03				7.63E+02		2.10E+04		1.94E-04		1.52E+02

TEDE	cpm	Child Thyroid	cpm
1.00E+02	7.63E+04	5.00E+02	7.59E+04
5.00E+01	3.82E+04	2.50E+02	3.80E+04
1.00E+03	7.63E+05	5.00E+03	7.59E+05

Monitor efficiencies from ERS-SFL-85-031
VS-112 LR SA10

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.05E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.05E+04 (Expression 5)

Isotope	U1 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	6.51E+01	2.80E-06	3.12E+03	8.72E-03	0.00E+00	0.00E+00	6.54E+00	2.81E-07	3.12E+03	8.77E-04
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.33E+02	1.00E-05	1.89E-05	1.89E-10	0.00E+00	0.00E+00	2.34E+01	1.01E-06	1.89E-05	1.90E-11
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	2.07E+04	8.88E-04	3.22E+03	2.86E+00	0.00E+00	0.00E+00	2.08E+03	8.92E-05	3.22E+03	2.87E-01
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.47E+02	6.34E-06	9.51E+05	6.03E+00	0.00E+00	0.00E+00	1.48E+01	6.37E-07	9.51E+05	6.06E-01
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	4.29E+02	1.84E-05	2.34E+06	4.32E+01	0.00E+00	0.00E+00	4.31E+01	1.85E-06	2.34E+06	4.34E+00
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.77E+00	1.62E-07	2.20E+06	3.56E-01	0.00E+00	0.00E+00	3.78E-01	1.63E-08	2.20E+06	3.58E-02
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	8.79E+02	3.78E-05	2.41E+04	9.10E-01	0.00E+00	0.00E+00	8.83E+01	3.79E-06	2.41E+04	9.15E-02
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.87E+02	3.38E-05	4.98E+04	1.68E+00	0.00E+00	0.00E+00	7.91E+01	3.40E-06	4.98E+04	1.69E-01
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	5.28E+04	2.27E-03	4.00E+04	9.07E+01	0.00E+00	0.00E+00	5.31E+03	2.28E-04	4.00E+04	9.11E+00
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.33E+04	1.00E-03	5.17E+05	5.17E+02	0.00E+00	0.00E+00	2.34E+03	1.01E-04	5.17E+05	5.20E+01
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	5.23E+03	2.25E-04	2.97E+05	6.68E+01	0.00E+00	0.00E+00	5.26E+02	2.26E-05	2.97E+05	6.72E+00
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.14E+01	4.90E-07	2.25E+05	1.10E-01	0.00E+00	0.00E+00	1.15E+00	4.92E-08	2.25E+05	1.11E-02
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.92E+01	3.40E-06	1.35E+06	4.60E+00	0.00E+00	0.00E+00	7.96E+00	3.42E-07	1.35E+06	4.62E-01
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.59E+01	1.11E-06	2.29E+04	2.55E-02	2.44E+07	6.04E+03	2.61E+00	1.12E-07	2.29E+04	2.56E-03
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.67E+01	1.15E-06	1.37E+05	1.57E-01	2.90E+05	7.38E+01	2.68E+00	1.15E-07	1.37E+05	1.58E-02
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.50E+01	1.93E-06	3.64E+04	7.03E-02	5.77E+06	2.48E+03	4.52E+00	1.94E-07	3.64E+04	7.07E-03
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	3.09E+01	1.33E-06	1.57E+05	2.09E-01	7.60E+04	2.24E+01	3.10E+00	1.33E-07	1.57E+05	2.10E-02
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.43E+01	1.47E-06	9.45E+04	1.39E-01	1.19E+06	3.89E+02	3.44E+00	1.48E-07	9.45E+04	1.40E-02
	4.01E+02			9.05E+02				7.35E+02		9.00E+03		4.53E-04		7.39E+01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	7.35E+04	5.00E+02	3.69E+04
5.00E+01	3.68E+04	2.50E+02	1.85E+04
1.00E+03	7.35E+05	5.00E+03	3.69E+05

Monitor efficiencies from ERS-SFL-85-031
VS-112 LR SA10

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 5.24E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.48E+05 (Expression 5)

Isotope	U1 & U2 FHA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	4.69E-01	0.00E+00	0.00E+00	0.00E+00	3.12E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.12E+03	0.00E+00
Kr-85m	1.04E-03	3.07E-08	8.17E+02	2.50E-05	1.61E-02	6.90E-10	1.89E-05	1.30E-14	0.00E+00	0.00E+00	7.61E-03	3.27E-10	1.89E-05	6.19E-15
Kr-85	4.78E+02	1.41E-02	1.12E+01	1.58E-01	7.38E+03	3.17E-04	3.22E+03	1.02E+00	0.00E+00	0.00E+00	3.50E+03	1.50E-04	3.22E+03	4.84E-01
Kr-87	0.00E+00	0.00E+00	4.47E+03	0.00E+00	0.00E+00	0.00E+00	9.51E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.51E+05	0.00E+00
Kr-88	0.00E+00	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	2.34E+06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.34E+06	0.00E+00
Kr-89	0.00E+00	0.00E+00	1.02E+04	0.00E+00	0.00E+00	0.00E+00	2.20E+06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.20E+06	0.00E+00
Xe-131m	4.66E+02	1.37E-02	4.29E+01	5.89E-01	7.19E+03	3.09E-04	2.41E+04	7.45E+00	0.00E+00	0.00E+00	3.41E+03	1.47E-04	2.41E+04	3.53E+00
Xe-133m	6.16E+02	1.82E-02	1.49E+02	2.71E+00	9.51E+03	4.09E-04	4.98E+04	2.03E+01	0.00E+00	0.00E+00	4.51E+03	1.94E-04	4.98E+04	9.64E+00
Xe-133	3.23E+04	9.52E-01	1.76E+02	1.68E+02	4.99E+05	2.14E-02	4.00E+04	8.56E+02	0.00E+00	0.00E+00	2.36E+05	1.02E-02	4.00E+04	4.06E+02
Xe-135m	2.65E+00	7.81E-05	2.15E+03	1.68E-01	4.09E+01	1.76E-06	5.17E+05	9.08E-01	0.00E+00	0.00E+00	1.94E+01	8.33E-07	5.17E+05	4.31E-01
Xe-135	6.10E+01	1.80E-03	1.25E+03	2.25E+00	9.42E+02	4.05E-05	2.97E+05	1.20E+01	0.00E+00	0.00E+00	4.46E+02	1.92E-05	2.97E+05	5.70E+00
Xe-137	0.00E+00	0.00E+00	9.55E+02	0.00E+00	0.00E+00	0.00E+00	2.25E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.25E+05	0.00E+00
Xe-138	0.00E+00	0.00E+00	6.27E+03	0.00E+00	0.00E+00	0.00E+00	1.35E+06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.35E+06	0.00E+00
I-131	5.20E-01	1.53E-05	4.66E+05	7.14E+00	8.03E+00	3.45E-07	2.29E+04	7.88E-03	2.44E+07	3.74E+02	3.81E+00	1.64E-07	2.29E+04	3.74E-03
I-132	2.52E-01	7.43E-06	4.33E+04	3.22E-01	3.89E+00	1.67E-07	1.37E+05	2.30E-02	2.90E+05	2.15E+00	1.84E+00	7.93E-08	1.37E+05	1.09E-02
I-133	3.35E-02	9.87E-07	1.28E+05	1.26E-01	5.17E-01	2.22E-08	3.64E+04	8.09E-04	5.77E+06	5.70E+00	2.45E-01	1.05E-08	3.64E+04	3.83E-04
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	1.57E+05	0.00E+00	7.60E+04	0.00E+00	0.00E+00	0.00E+00	1.57E+05	0.00E+00
I-135	2.23E-05	6.57E-10	7.10E+04	4.67E-05	3.44E-04	1.48E-11	9.45E+04	1.40E-06	1.19E+06	7.82E-04	1.63E-04	7.01E-12	9.45E+04	6.62E-07
	3.39E+04			1.81E+02				8.98E+02		3.82E+02		1.07E-02		4.26E+02

TEDE	cpm	Child Thyroid	cpm
1.00E+02	8.98E+04	5.00E+02	2.13E+05
5.00E+01	4.49E+04	2.50E+02	1.06E+05
1.00E+03	8.98E+05	5.00E+03	2.13E+06

Monitor efficiencies from ERS-SFL-85-031
VS-112 LR SA10

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.327E+07 cc/s

X/Q = 9.240E-05 s/m³
Release (uCi/s) CF for TEDE = 2.202E+05 (Expression 6)
Release (uCi/s) CF for Child Thyroid = 1.216E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	5.45E+02	2.34E-05	3.118E+03	7.306E-02
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.30E+03	5.59E-05	1.891E-05	1.058E-09
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	3.17E+03	1.36E-04	3.218E+03	4.382E-01
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	7.45E+02	3.20E-05	9.512E+05	3.045E+01
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.33E+03	1.00E-04	2.344E+06	2.343E+02
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	5.37E+01	2.31E-06	2.200E+06	5.074E+00
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.65E+03	1.14E-04	2.411E+04	2.751E+00
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	3.18E+03	1.37E-04	4.977E+04	6.807E+00
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.88E+05	8.10E-03	3.995E+04	3.234E+02
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	2.03E+03	8.71E-05	5.166E+05	4.499E+01
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.51E+04	6.50E-04	2.973E+05	1.933E+02
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.38E+02	5.94E-06	2.251E+05	1.336E+00
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.82E+02	2.07E-05	1.350E+06	2.799E+01
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	6.47E+00	2.78E-07	2.285E+04	6.349E-03
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.23E-01	9.57E-09	1.374E+05	1.315E-03
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	2.21E+00	9.51E-08	3.638E+04	3.459E-03
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.33E-01	5.70E-09	1.574E+05	8.989E-04
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	8.29E-01	3.56E-08	9.446E+04	3.380E-03
	1.54E+04			4.31E+02				8.710E+02

Isotope	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.000E+00	0.000E+00	3.012E+02	1.295E-05	3.118E+03	4.037E-02
Kr-85m	0.000E+00	0.000E+00	7.192E+02	3.091E-05	1.891E-05	5.845E-10
Kr-85	0.000E+00	0.000E+00	1.751E+03	7.524E-05	3.218E+03	2.421E-01
Kr-87	0.000E+00	0.000E+00	4.117E+02	1.769E-05	9.512E+05	1.683E+01
Kr-88	0.000E+00	0.000E+00	1.285E+03	5.524E-05	2.344E+06	1.295E+02
Kr-89	0.000E+00	0.000E+00	2.965E+01	1.274E-06	2.200E+06	2.803E+00
Xe-131m	0.000E+00	0.000E+00	1.467E+03	6.304E-05	2.411E+04	1.520E+00
Xe-133m	0.000E+00	0.000E+00	1.759E+03	7.558E-05	4.977E+04	3.761E+00
Xe-133	0.000E+00	0.000E+00	1.041E+05	4.474E-03	3.995E+04	1.787E+02
Xe-135m	0.000E+00	0.000E+00	1.120E+03	4.812E-05	5.166E+05	2.486E+01
Xe-135	0.000E+00	0.000E+00	8.359E+03	3.592E-04	2.973E+05	1.068E+02
Xe-137	0.000E+00	0.000E+00	7.634E+01	3.281E-06	2.251E+05	7.385E-01
Xe-138	0.000E+00	0.000E+00	2.666E+02	1.145E-05	1.350E+06	1.546E+01
I-131	2.440E+07	7.166E+02	3.572E+00	1.535E-07	2.285E+04	3.508E-03
I-132	2.800E+05	2.933E-01	1.230E-01	5.287E-09	1.374E+05	7.264E-04
I-133	5.770E+06	5.798E+01	1.222E+00	5.253E-08	3.638E+04	1.911E-03
I-134	7.600E+04	4.577E-02	7.326E-02	3.148E-09	1.674E+05	4.956E-04
I-135	1.190E+06	4.474E+00	4.574E-01	1.966E-08	9.446E+04	1.857E-03
		7.793E+02		5.228E-03		4.813E+02

TEDE	cpm	Child Thyroid	cpm
100	8.71E+04	500	2.41E+05
50	4.36E+04	250	1.20E+05
1000	8.71E+05	5000	2.41E+06

X/Q = 9.24E-05 s/m³

Monitor efficiencies from ERS-SFL-85-031 — Upstream filtration (iodines reduced 0.01) — Release (uCi/s) CF for TEDE = 1.31E+05 (Expression 5)

VS-112 HR SA9 — Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s — Release (uCi/s) CF for Child Thyroid = 5.75E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.64E+02	1.14E-05	4.13E-01	4.70E-06	0.00E+00	0.00E+00	1.16E+01	4.99E-07	4.13E-01	2.06E-07
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	6.49E+02	2.79E-05	2.51E+01	6.99E-04	0.00E+00	0.00E+00	2.85E+01	1.22E-06	2.51E+01	3.07E-05
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.73E+03	1.60E-04	9.22E-01	1.48E-04	0.00E+00	0.00E+00	1.64E+02	7.04E-06	9.22E-01	6.49E-06
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.48E+02	1.07E-05	1.26E+02	1.34E-03	0.00E+00	0.00E+00	1.09E+01	4.68E-07	1.26E+02	5.91E-05
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	1.05E+03	4.52E-05	3.11E+02	1.40E-02	0.00E+00	0.00E+00	4.62E+01	1.98E-06	3.11E+02	6.17E-04
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	2.20E-01	9.46E-09	2.92E+02	2.76E-06	0.00E+00	0.00E+00	9.67E-03	4.16E-10	2.92E+02	1.21E-07
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	2.13E+03	9.16E-05	3.20E+00	2.93E-04	0.00E+00	0.00E+00	9.36E+01	4.02E-06	3.20E+00	1.29E-05
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.86E+03	7.98E-05	6.60E+00	5.27E-04	0.00E+00	0.00E+00	8.16E+01	3.51E-06	6.60E+00	2.31E-05
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	1.09E+05	4.69E-03	3.27E+00	1.54E-02	0.00E+00	0.00E+00	4.80E+03	2.06E-04	3.27E+00	6.75E-04
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.64E+03	1.56E-04	6.85E+01	1.07E-02	0.00E+00	0.00E+00	1.60E+02	6.87E-06	6.85E+01	4.71E-04
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.95E+03	3.42E-04	3.94E+01	1.35E-02	0.00E+00	0.00E+00	3.49E+02	1.50E-05	3.94E+01	5.92E-04
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	7.48E-01	3.22E-08	2.98E+01	9.60E-07	0.00E+00	0.00E+00	3.29E-02	1.41E-09	2.98E+01	4.22E-08
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.29E+01	9.84E-07	1.79E+02	1.76E-04	0.00E+00	0.00E+00	1.01E+00	4.32E-08	1.79E+02	7.74E-06
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	8.01E+01	3.44E-06	3.03E+00	1.04E-05	2.44E+07	1.49E+04	3.52E+00	1.51E-07	3.03E+00	4.58E-07
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.87E+01	1.66E-06	1.82E+01	3.03E-05	2.90E+05	8.58E+01	1.70E+00	7.32E-08	1.82E+01	1.33E-06
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	3.11E+01	1.34E-06	4.82E+00	6.45E-06	5.77E+06	1.37E+03	1.37E+00	5.87E-08	4.82E+00	2.83E-07
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.91E+00	8.21E-08	2.09E+01	1.71E-06	7.60E+04	1.11E+00	8.39E-02	3.61E-09	2.09E+01	7.53E-08
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	9.92E+00	4.26E-07	1.25E+01	5.34E-06	1.19E+06	9.02E+01	4.36E-01	1.87E-08	1.25E+01	2.35E-07
	4.46E+04			7.24E+02				5.69E-02		1.65E+04		2.47E-04		2.50E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	5.68E+00	5.00E+02	1.25E+00
5.00E+01	2.84E+00	2.50E+02	6.24E-01
1.00E+03	5.68E+01	5.00E+03	1.25E+01

X/Q = 9.24E-05 s/m³

Monitor efficiencies from ERS-SFL-85-031 — Upstream filtration (iodines reduced 0.01) — Release (uCi/s) CF for TEDE = 1.51E+05 (Expression 5)

VS-112 HR SA9 — Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s — Release (uCi/s) CF for Child Thyroid = 8.58E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	3.10E+02	1.33E-05	4.13E-01	5.51E-06	0.00E+00	0.00E+00	1.76E+01	7.56E-07	4.13E-01	3.12E-07
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	7.60E+02	3.27E-05	2.51E+01	8.19E-04	0.00E+00	0.00E+00	4.31E+01	1.85E-06	2.51E+01	4.64E-05
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	2.19E+03	9.40E-05	9.22E-01	8.67E-05	0.00E+00	0.00E+00	1.24E+02	5.33E-06	9.22E-01	4.92E-06
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.91E+02	1.25E-05	1.26E+02	1.58E-03	0.00E+00	0.00E+00	1.65E+01	7.10E-07	1.26E+02	8.95E-05
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.23E+03	5.30E-05	3.11E+02	1.65E-02	0.00E+00	0.00E+00	7.00E+01	3.01E-06	3.11E+02	9.35E-04
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.58E-01	1.11E-08	2.92E+02	3.24E-06	0.00E+00	0.00E+00	1.47E-02	6.30E-10	2.92E+02	1.84E-07
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.50E+03	1.07E-04	3.20E+00	3.43E-04	0.00E+00	0.00E+00	1.42E+02	6.09E-06	3.20E+00	1.95E-05
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	2.19E+03	9.40E-05	6.60E+00	6.21E-04	0.00E+00	0.00E+00	1.24E+02	5.33E-06	6.60E+00	3.52E-05
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.28E+05	5.50E-03	3.27E+00	1.80E-02	0.00E+00	0.00E+00	7.26E+03	3.12E-04	3.27E+00	1.02E-03
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	4.27E+03	1.84E-04	6.85E+01	1.26E-02	0.00E+00	0.00E+00	2.42E+02	1.04E-05	6.85E+01	7.13E-04
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	9.34E+03	4.01E-04	3.94E+01	1.58E-02	0.00E+00	0.00E+00	5.30E+02	2.28E-05	3.94E+01	8.97E-04
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	8.77E-01	3.77E-08	2.98E+01	1.12E-06	0.00E+00	0.00E+00	4.97E-02	2.14E-09	2.98E+01	6.38E-08
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.69E+01	1.16E-06	1.79E+02	2.07E-04	0.00E+00	0.00E+00	1.52E+00	6.55E-08	1.79E+02	1.17E-05
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.88E+01	2.53E-06	3.03E+00	7.65E-06	2.44E+07	9.48E+03	3.33E+00	1.43E-07	3.03E+00	4.34E-07
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.55E+01	1.96E-06	1.82E+01	3.56E-05	2.90E+05	8.72E+01	2.58E+00	1.11E-07	1.82E+01	2.02E-06
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.65E+01	1.57E-06	4.82E+00	7.57E-06	5.77E+06	1.39E+03	2.07E+00	8.90E-08	4.82E+00	4.29E-07
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.24E+00	9.63E-08	2.09E+01	2.01E-06	7.60E+04	1.13E+00	1.27E-01	5.46E-09	2.09E+01	1.14E-07
I-135	6.76E+01	7.69E-05	7.10E+04	5.46E+00	1.16E+01	5.00E-07	1.25E+01	6.26E-06	1.19E+06	9.15E+01	6.60E-01	2.83E-08	1.25E+01	3.55E-07
	8.78E+05			6.27E+02				6.68E-02		1.10E+04		3.69E-04		3.78E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	6.66E+00	5.00E+02	1.89E+00
5.00E+01	3.33E+00	2.50E+02	9.44E-01
1.00E+03	6.66E+01	5.00E+03	1.89E+01

Monitor efficiencies from ERS-SFL-85-031 — Upstream filtration (iodines reduced 0.01)
VS-112 HR SA9 — Release Flow Rate = 4.93E+04 cfm 2.33E+07 cc/s

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 7.15E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.95E+04 (Expression 5)

Isotope	U1 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.63E+01	6.99E-07	4.13E-01	2.89E-07	0.00E+00	0.00E+00	8.98E-01	3.86E-08	4.13E-01	1.60E-08
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.71E+01	2.88E-06	2.51E+01	7.23E-05	0.00E+00	0.00E+00	3.71E+00	1.59E-07	2.51E+01	3.99E-06
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.97E+05	1.70E-02	9.22E-01	1.57E-02	0.00E+00	0.00E+00	2.19E+04	9.42E-04	9.22E-01	8.68E-04
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	8.54E+00	3.67E-07	1.26E+02	4.63E-05	0.00E+00	0.00E+00	4.72E-01	2.03E-08	1.26E+02	2.56E-06
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	7.30E+01	3.14E-06	3.11E+02	9.75E-04	0.00E+00	0.00E+00	4.03E+00	1.73E-07	3.11E+02	5.39E-05
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.54E-04	1.52E-11	2.92E+02	4.44E-09	0.00E+00	0.00E+00	1.96E-05	8.41E-13	2.92E+02	2.45E-10
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.43E+04	6.15E-04	3.20E+00	1.97E-03	0.00E+00	0.00E+00	7.91E+02	3.40E-05	3.20E+00	1.09E-04
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	2.20E+03	9.44E-05	6.60E+00	6.23E-04	0.00E+00	0.00E+00	1.21E+02	5.21E-06	6.60E+00	3.44E-05
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	3.01E+05	1.29E-02	3.27E+00	4.23E-02	0.00E+00	0.00E+00	1.66E+04	7.14E-04	3.27E+00	2.34E-03
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.47E+02	6.31E-06	6.85E+01	4.32E-04	0.00E+00	0.00E+00	8.11E+00	3.48E-07	6.85E+01	2.39E-05
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.26E+02	9.70E-06	3.94E+01	3.82E-04	0.00E+00	0.00E+00	1.25E+01	5.36E-07	3.94E+01	2.11E-05
Xe-137	1.19E-07	2.02E-09	9.56E+02	1.93E-06	1.44E-03	6.20E-11	2.98E+01	1.85E-09	0.00E+00	0.00E+00	7.97E-05	3.43E-12	2.98E+01	1.02E-10
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.60E-01	6.88E-09	1.79E+02	1.23E-06	0.00E+00	0.00E+00	8.85E-03	3.80E-10	1.79E+02	6.80E-08
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	6.56E+01	2.82E-06	3.03E+00	8.54E-06	2.44E+07	2.24E+03	3.63E+00	1.56E-07	3.03E+00	4.72E-07
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	4.39E+01	1.89E-06	1.82E+01	3.44E-05	2.90E+05	1.78E+01	2.43E+00	1.04E-07	1.82E+01	1.90E-06
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.67E+01	7.19E-07	4.82E+00	3.47E-06	5.77E+06	1.35E+02	9.25E-01	3.97E-08	4.82E+00	1.92E-07
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	4.38E-01	1.88E-08	2.09E+01	3.93E-07	7.60E+04	4.66E-02	2.42E-02	1.04E-09	2.09E+01	2.17E-08
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.56E+00	1.96E-07	1.25E+01	2.45E-06	1.19E+06	7.59E+00	2.52E-01	1.08E-08	1.25E+01	1.36E-07
	5.89E+01			1.33E+02				6.26E-02		2.40E+03		1.70E-03		3.46E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	6.26E+00	5.00E+02	1.73E+00
5.00E+01	3.13E+00	2.50E+02	8.64E-01
1.00E+03	6.26E+01	5.00E+03	1.73E+01

Monitor efficiencies from ERS-SFL-85-031 — Pre-release Iodine mitigation in ERS-MPD-01-002 (Iodines reduced 0.005)
VS-112 HR SA9 — Release Flow Rate = 4.93E+04 cfm 2.33E+07 cc/s

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 2.26E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 4.50E+03 (Expression 5)

Isotope	U1 only LOCA TID (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.96E+02	1.27E-05	4.13E-01	5.25E-06	0.00E+00	0.00E+00	5.88E+01	2.53E-06	4.13E-01	1.05E-06
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	6.10E+02	2.62E-05	2.51E+01	6.57E-04	0.00E+00	0.00E+00	1.21E+02	5.21E-06	2.51E+01	1.31E-04
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.59E+01	1.11E-06	9.22E-01	1.02E-06	0.00E+00	0.00E+00	5.14E+00	2.21E-07	9.22E-01	2.04E-07
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.22E+03	5.25E-05	1.26E+02	6.62E-03	0.00E+00	0.00E+00	2.43E+02	1.04E-05	1.26E+02	1.32E-03
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.70E+03	7.29E-05	3.11E+02	2.27E-02	0.00E+00	0.00E+00	3.38E+02	1.45E-05	3.11E+02	4.51E-03
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	2.11E+03	9.07E-05	2.92E+02	2.65E-02	0.00E+00	0.00E+00	4.20E+02	1.80E-05	2.92E+02	5.26E-03
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.38E+01	1.45E-06	3.20E+00	4.64E-06	0.00E+00	0.00E+00	6.72E+00	2.89E-07	3.20E+00	9.22E-07
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.58E+02	6.78E-06	6.60E+00	4.48E-05	0.00E+00	0.00E+00	3.14E+01	1.35E-06	6.60E+00	8.90E-06
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	5.00E+03	2.15E-04	3.27E+00	7.04E-04	0.00E+00	0.00E+00	9.96E+02	4.28E-05	3.27E+00	1.40E-04
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	1.05E+03	4.51E-05	6.85E+01	3.09E-03	0.00E+00	0.00E+00	2.09E+02	8.98E-06	6.85E+01	6.15E-04
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.51E+03	6.50E-05	3.94E+01	2.56E-03	0.00E+00	0.00E+00	3.01E+02	1.29E-05	3.94E+01	5.10E-04
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.56E+03	1.96E-04	2.98E+01	5.85E-03	0.00E+00	0.00E+00	9.08E+02	3.90E-05	2.98E+01	1.16E-03
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	4.25E+03	1.83E-04	1.79E+02	3.27E-02	0.00E+00	0.00E+00	8.46E+02	3.63E-05	1.79E+02	6.51E-03
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.22E+01	5.23E-07	3.03E+00	1.58E-06	2.44E+07	1.31E+04	2.42E+00	1.04E-07	3.03E+00	3.15E-07
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.78E+01	7.66E-07	1.82E+01	1.40E-05	2.90E+05	2.28E+02	3.54E+00	1.52E-07	1.82E+01	2.78E-06
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.50E+01	1.07E-06	4.82E+00	5.18E-06	5.77E+06	6.37E+03	4.98E+00	2.14E-07	4.82E+00	1.03E-06
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.77E+01	1.19E-06	2.09E+01	2.48E-05	7.60E+04	9.29E+01	5.50E+00	2.37E-07	2.09E+01	4.94E-06
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.38E+01	1.02E-06	1.25E+01	1.28E-05	1.19E+06	1.25E+03	4.73E+00	2.03E-07	1.25E+01	2.54E-06
	7.24E+08			4.19E+03				1.01E-01		2.10E+04		1.94E-04		2.02E-02

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.01E+01	5.00E+02	1.01E+01
5.00E+01	5.07E+00	2.50E+02	5.04E+00
1.00E+03	1.01E+02	5.00E+03	1.01E+02

Monitor efficiencies from ERS-SFL-85-031
VS-112 HR SA9

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.05E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.05E+04 (Expression 5)

Isotope	U1 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	6.51E+01	2.80E-06	4.13E-01	1.16E-06	0.00E+00	0.00E+00	6.54E+00	2.81E-07	4.13E-01	1.16E-07
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.33E+02	1.00E-05	2.51E+01	2.51E-04	0.00E+00	0.00E+00	2.34E+01	1.01E-06	2.51E+01	2.52E-05
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	2.07E+04	8.88E-04	9.22E-01	8.18E-04	0.00E+00	0.00E+00	2.08E+03	8.92E-05	9.22E-01	8.23E-05
Kr-87	5.84E-01	1.41E-03	4.47E+03	6.29E+00	1.47E+02	6.34E-06	1.26E+02	7.99E-04	0.00E+00	0.00E+00	1.48E+01	6.37E-07	1.26E+02	8.03E-05
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	4.29E+02	1.84E-05	3.11E+02	5.73E-03	0.00E+00	0.00E+00	4.31E+01	1.85E-06	3.11E+02	5.76E-04
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.77E+00	1.62E-07	2.92E+02	4.72E-05	0.00E+00	0.00E+00	3.78E-01	1.63E-08	2.92E+02	4.74E-06
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	8.79E+02	3.78E-05	3.20E+00	1.21E-04	0.00E+00	0.00E+00	8.83E+01	3.79E-06	3.20E+00	1.21E-05
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.87E+02	3.38E-05	6.60E+00	2.23E-04	0.00E+00	0.00E+00	7.91E+01	3.40E-06	6.60E+00	2.24E-05
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	5.28E+04	2.27E-03	3.27E+00	7.43E-03	0.00E+00	0.00E+00	5.31E+03	2.28E-04	3.27E+00	7.47E-04
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.33E+04	1.00E-03	6.85E+01	6.86E-02	0.00E+00	0.00E+00	2.34E+03	1.01E-04	6.85E+01	6.89E-03
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	5.23E+03	2.25E-04	3.94E+01	8.86E-03	0.00E+00	0.00E+00	5.26E+02	2.26E-05	3.94E+01	8.90E-04
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.14E+01	4.90E-07	2.98E+01	1.46E-05	0.00E+00	0.00E+00	1.15E+00	4.92E-08	2.98E+01	1.47E-06
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.92E+01	3.40E-06	1.79E+02	6.09E-04	0.00E+00	0.00E+00	7.96E+00	3.42E-07	1.79E+02	6.13E-05
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.59E+01	1.11E-06	3.03E+00	3.38E-06	2.44E+07	6.04E+03	2.61E+00	1.12E-07	3.03E+00	3.39E-07
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.67E+01	1.15E-06	1.82E+01	2.09E-05	2.90E+05	7.38E+01	2.68E+00	1.15E-07	1.82E+01	2.10E-06
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.50E+01	1.93E-06	4.82E+00	9.32E-06	5.77E+06	2.48E+03	4.52E+00	1.94E-07	4.82E+00	9.37E-07
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	3.09E+01	1.33E-06	2.09E+01	2.77E-05	7.60E+04	2.24E+01	3.10E+00	1.33E-07	2.09E+01	2.78E-06
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.43E+01	1.47E-06	1.25E+01	1.84E-05	1.19E+06	3.89E+02	3.44E+00	1.48E-07	1.25E+01	1.85E-06
	4.01E+02			9.05E+02				9.35E-02		9.00E+03		4.53E-04		9.40E-03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	9.35E+00	5.00E+02	4.70E+00
5.00E+01	4.68E+00	2.50E+02	2.35E+00
1.00E+03	9.35E+01	5.00E+03	4.70E+01

Monitor efficiencies from ERS-SFL-85-031
VS-112 HR SA9

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm • 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 5.24E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.48E+05 (Expression 5)

Isotope	U1 & U2 FHA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	4.69E-01	0.00E+00	0.00E+00	0.00E+00	4.13E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.13E-01	0.00E+00
Kr-85m	1.04E-03	3.07E-08	8.17E+02	2.50E-05	1.61E-02	6.90E-10	2.51E+01	1.73E-08	0.00E+00	0.00E+00	7.61E-03	3.27E-10	2.51E+01	8.20E-09
Kr-85	4.78E+02	1.41E-02	1.12E+01	1.58E-01	7.38E+03	3.17E-04	9.22E-01	2.92E-04	0.00E+00	0.00E+00	3.50E+03	1.50E-04	9.22E-01	1.39E-04
Kr-87	0.00E+00	0.00E+00	4.47E+03	0.00E+00	0.00E+00	0.00E+00	1.26E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E+02	0.00E+00
Kr-88	0.00E+00	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	3.11E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.11E+02	0.00E+00
Kr-89	0.00E+00	0.00E+00	1.02E+04	0.00E+00	0.00E+00	0.00E+00	2.92E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.92E+02	0.00E+00
Xe-131m	4.66E+02	1.37E-02	4.29E+01	5.89E-01	7.19E+03	3.09E-04	3.20E+00	9.88E-04	0.00E+00	0.00E+00	3.41E+03	1.47E-04	3.20E+00	4.68E-04
Xe-133m	6.16E+02	1.82E-02	1.49E+02	2.71E+00	9.51E+03	4.09E-04	6.60E+00	2.70E-03	0.00E+00	0.00E+00	4.51E+03	1.94E-04	6.60E+00	1.28E-03
Xe-133	3.23E+04	9.52E-01	1.76E+02	1.68E+02	4.99E+05	2.14E-02	3.27E+00	7.02E-02	0.00E+00	0.00E+00	2.36E+05	1.02E-02	3.27E+00	3.33E-02
Xe-135m	2.65E+00	7.81E-05	2.15E+03	1.68E-01	4.09E+01	1.76E-06	6.85E+01	1.20E-04	0.00E+00	0.00E+00	1.94E+01	8.33E-07	6.85E+01	5.71E-05
Xe-135	6.10E+01	1.80E-03	1.25E+03	2.25E+00	9.42E+02	4.05E-05	3.94E+01	1.60E-03	0.00E+00	0.00E+00	4.46E+02	1.92E-05	3.94E+01	7.56E-04
Xe-137	0.00E+00	0.00E+00	9.55E+02	0.00E+00	0.00E+00	0.00E+00	2.98E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.98E+01	0.00E+00
Xe-138	0.00E+00	0.00E+00	6.27E+03	0.00E+00	0.00E+00	0.00E+00	1.79E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E+02	0.00E+00
I-131	5.20E-01	1.53E-05	4.66E+05	7.14E+00	8.03E+00	3.45E-07	3.03E+00	1.05E-06	2.44E+07	3.74E+02	3.81E+00	1.64E-07	3.03E+00	4.96E-07
I-132	2.52E-01	7.43E-06	4.33E+04	3.22E-01	3.89E+00	1.67E-07	1.82E+01	3.05E-06	2.90E+05	2.15E+00	1.84E+00	7.93E-08	1.82E+01	1.44E-06
I-133	3.35E-02	9.87E-07	1.28E+05	1.26E-01	5.17E-01	2.22E-08	4.82E+00	1.07E-07	5.77E+06	5.70E+00	2.45E-01	1.05E-08	4.82E+00	5.08E-08
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	2.09E+01	0.00E+00	7.60E+04	0.00E+00	0.00E+00	0.00E+00	2.09E+01	0.00E+00
I-135	2.23E-05	6.57E-10	7.10E+04	4.67E-05	3.44E-04	1.48E-11	1.25E+01	1.85E-10	1.19E+06	7.82E-04	1.63E-04	7.01E-12	1.25E+01	8.78E-11
	3.39E+04			1.81E+02				7.59E-02		3.82E+02		1.07E-02		3.60E-02

TEDE	cpm	Child Thyroid	cpm
1.00E+02	7.59E+00	5.00E+02	1.80E+01
5.00E+01	3.79E+00	2.50E+02	8.99E+00
1.00E+03	7.59E+01	5.00E+03	1.80E+02

Monitor efficiencies from ERS-SFL-85-031
VS-112 HR SA9

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.327E+07 cc/s

X/Q = 9.240E-05 s/m^3
Release (uCi/s) CF for TEDE = 2.202E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.216E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	5.45E+02	2.34E-05	4.134E-01	9.686E-06
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.30E+03	5.59E-05	2.507E+01	1.402E-03
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	3.17E+03	1.36E-04	9.220E-01	1.255E-04
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	7.45E+02	3.20E-05	1.261E+02	4.037E-03
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.33E+03	1.00E-04	3.108E+02	3.107E-02
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	5.37E+01	2.31E-06	2.917E+02	6.727E-04
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.65E+03	1.14E-04	3.196E+00	3.646E-04
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	3.18E+03	1.37E-04	6.598E+00	9.025E-04
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.88E+05	8.10E-03	3.274E+00	2.651E-02
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	2.03E+03	8.71E-05	6.848E+01	5.964E-03
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.51E+04	6.50E-04	3.942E+01	2.563E-02
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.38E+02	5.94E-06	2.984E+01	1.772E-04
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.82E+02	2.07E-06	1.790E+02	3.711E-03
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	6.47E+00	2.78E-07	3.030E+00	6.419E-07
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.23E-01	9.57E-09	1.822E+01	1.743E-07
I-133	1.56E-01	1.00E-05	1.28E+05	1.29E+00	2.21E+00	9.51E-08	4.823E+00	4.585E-07
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.33E-01	5.70E-09	2.087E+01	1.189E-07
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	8.28E-01	3.56E-08	1.252E+01	4.454E-07
	1.54E+04			4.31E+02				1.006E-01

Isotope	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.000E+00	0.000E+00	3.012E+02	1.295E-05	4.134E-01	5.352E-06
Kr-85m	0.000E+00	0.000E+00	7.192E+02	3.091E-05	2.507E+01	7.749E-04
Kr-85	0.000E+00	0.000E+00	1.751E+03	7.524E-05	9.220E-01	6.937E-05
Kr-87	0.000E+00	0.000E+00	4.117E+02	1.769E-05	1.261E+02	2.231E-03
Kr-88	0.000E+00	0.000E+00	1.285E+03	5.524E-05	3.108E+02	1.717E-02
Kr-89	0.000E+00	0.000E+00	2.965E+01	1.274E-06	2.917E+02	3.717E-04
Xe-131m	0.000E+00	0.000E+00	1.467E+03	6.304E-05	3.196E+00	2.015E-04
Xe-133m	0.000E+00	0.000E+00	1.759E+03	7.558E-05	6.598E+00	4.986E-04
Xe-133	0.000E+00	0.000E+00	1.041E+05	4.474E-03	3.274E+00	1.465E-02
Xe-135m	0.000E+00	0.000E+00	1.120E+03	4.812E-05	6.848E+01	3.296E-03
Xe-135	0.000E+00	0.000E+00	8.359E+03	3.592E-04	3.942E+01	1.416E-02
Xe-137	0.000E+00	0.000E+00	7.634E+01	3.281E-06	2.984E+01	9.789E-05
Xe-138	0.000E+00	0.000E+00	2.666E+02	1.145E-05	1.790E+02	2.050E-03
I-131	2.440E+07	7.166E+02	3.572E+00	1.635E-07	3.030E+00	4.652E-07
I-132	2.900E+05	2.933E-01	1.230E-01	5.287E-09	1.822E+01	9.633E-08
I-133	5.770E+06	5.798E+01	1.222E+00	5.253E-08	4.823E+00	2.534E-07
I-134	7.600E+04	4.577E-02	7.326E-02	3.148E-09	2.087E+01	6.571E-08
I-135	1.190E+06	4.474E+00	4.574E-01	1.966E-08	1.252E+01	2.461E-07
		7.793E+02		5.228E-03		5.557E-02

TEDE	cpm	Child Thyroid	cpm
100	1.01E+01	500	2.78E+01
50	5.03E+00	250	1.39E+01
1000	1.01E+02	5000	2.78E+02

Monitor efficiencies from ERS-SFL-85-031
VS-107B Victoreen

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 1.31E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 5.75E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.64E+02	1.14E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E+01	4.99E-07	0.00E+00	0.00E+00
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	6.49E+02	2.79E-05	5.16E+07	1.44E+03	0.00E+00	0.00E+00	2.85E+01	1.22E-06	5.16E+07	6.32E+01
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.73E+03	1.60E-04	5.04E+07	8.07E+03	0.00E+00	0.00E+00	1.64E+02	7.04E-06	5.04E+07	3.55E+02
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.48E+02	1.07E-05	9.61E+07	1.02E+03	0.00E+00	0.00E+00	1.09E+01	4.68E-07	9.61E+07	4.50E+01
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	1.05E+03	4.52E-05	5.16E+07	2.33E+03	0.00E+00	0.00E+00	4.62E+01	1.98E-06	5.16E+07	1.02E+02
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	2.20E-01	9.46E-09	9.59E+07	9.07E-01	0.00E+00	0.00E+00	9.67E-03	4.16E-10	9.59E+07	3.99E-02
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	2.13E+03	9.16E-05	2.94E+07	2.69E+03	0.00E+00	0.00E+00	9.36E+01	4.02E-06	2.94E+07	1.18E+02
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.86E+03	7.98E-05	4.17E+07	3.33E+03	0.00E+00	0.00E+00	8.16E+01	3.51E-06	4.17E+07	1.46E+02
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	1.09E+05	4.69E-03	2.29E+07	1.07E+05	0.00E+00	0.00E+00	4.80E+03	2.06E-04	2.29E+07	4.71E+03
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.64E+03	1.56E-04	1.51E+07	2.36E+03	0.00E+00	0.00E+00	1.60E+02	6.87E-06	1.51E+07	1.04E+02
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.95E+03	3.42E-04	6.42E+07	2.20E+04	0.00E+00	0.00E+00	3.49E+02	1.50E-05	6.42E+07	9.64E+02
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	7.48E-01	3.22E-08	1.05E+08	3.38E+00	0.00E+00	0.00E+00	3.29E-02	1.41E-09	1.05E+08	1.49E-01
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.29E+01	9.84E-07	7.35E+07	7.23E+01	0.00E+00	0.00E+00	1.01E+00	4.32E-08	7.35E+07	3.18E+00
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	8.01E+01	3.44E-06	4.41E+07	1.52E+02	2.44E+07	1.49E+04	3.52E+00	1.51E-07	4.41E+07	6.67E+00
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.87E+01	1.66E-06	7.31E+07	1.22E+02	2.90E+05	8.58E+01	1.70E+00	7.32E-08	7.31E+07	5.35E+00
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	3.11E+01	1.34E-06	6.89E+07	9.22E+01	5.77E+06	1.37E+03	1.37E+00	5.87E-08	6.89E+07	4.05E+00
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.91E+00	8.21E-08	8.06E+07	6.62E+00	7.60E+04	1.11E+00	8.39E-02	3.61E-09	8.06E+07	2.91E-01
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	9.92E+00	4.26E-07	6.30E+07	2.69E+01	1.19E+06	9.02E+01	4.36E-01	1.87E-08	6.30E+07	1.18E+00
	4.46E+04			7.24E+02				1.51E+05		1.65E+04		2.47E-04		6.63E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.51E+07	5.00E+02	3.31E+06
5.00E+01	7.54E+06	2.50E+02	1.66E+06
1.00E+03	1.51E+08	5.00E+03	3.31E+07

Monitor efficiencies from ERS-SFL-85-031
VS-107B Victoreen

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 1.51E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 8.58E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	3.10E+02	1.33E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E+01	7.56E-07	0.00E+00	0.00E+00
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	7.60E+02	3.27E-05	5.16E+07	1.69E+03	0.00E+00	0.00E+00	4.31E+01	1.85E-06	5.16E+07	9.56E+01
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	2.19E+03	9.40E-05	5.04E+07	4.74E+03	0.00E+00	0.00E+00	1.24E+02	5.33E-06	5.04E+07	2.69E+02
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.91E+02	1.25E-05	9.61E+07	1.20E+03	0.00E+00	0.00E+00	1.65E+01	7.10E-07	9.61E+07	6.82E+01
Kr-88	7.16E+03	8.16E-03	1.13E+04	9.21E+01	1.23E+03	5.30E-05	5.16E+07	2.74E+03	0.00E+00	0.00E+00	7.00E+01	3.01E-06	5.16E+07	1.55E+02
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.58E-01	1.11E-08	9.59E+07	1.07E+00	0.00E+00	0.00E+00	1.47E-02	6.30E-10	9.59E+07	6.04E-02
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.50E+03	1.07E-04	2.94E+07	3.16E+03	0.00E+00	0.00E+00	1.42E+02	6.09E-06	2.94E+07	1.79E+02
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	2.19E+03	9.40E-05	4.17E+07	3.92E+03	0.00E+00	0.00E+00	1.24E+02	5.33E-06	4.17E+07	2.22E+02
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.28E+05	5.50E-03	2.29E+07	1.26E+05	0.00E+00	0.00E+00	7.26E+03	3.12E-04	2.29E+07	7.13E+03
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	4.27E+03	1.84E-04	1.51E+07	2.77E+03	0.00E+00	0.00E+00	2.42E+02	1.04E-05	1.51E+07	1.57E+02
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	9.34E+03	4.01E-04	6.42E+07	2.58E+04	0.00E+00	0.00E+00	5.30E+02	2.28E-05	6.42E+07	1.46E+03
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	8.77E-01	3.77E-08	1.05E+08	3.97E+00	0.00E+00	0.00E+00	4.97E-02	2.14E-09	1.05E+08	2.25E-01
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.69E+01	1.16E-06	7.35E+07	8.49E+01	0.00E+00	0.00E+00	1.52E+00	6.55E-08	7.35E+07	4.82E+00
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.88E+01	2.53E-06	4.41E+07	1.11E+02	2.44E+07	9.48E+03	3.33E+00	1.43E-07	4.41E+07	6.31E+00
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.55E+01	1.96E-06	7.31E+07	1.43E+02	2.90E+05	8.72E+01	2.58E+00	1.11E-07	7.31E+07	8.10E+00
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.65E+01	1.57E-06	6.89E+07	1.08E+02	5.77E+06	1.39E+03	2.07E+00	8.90E-08	6.89E+07	6.14E+00
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.24E+00	9.63E-08	8.06E+07	7.76E+00	7.60E+04	1.13E+00	1.27E-01	5.46E-09	8.06E+07	4.40E-01
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.16E+01	5.00E-07	6.30E+07	3.15E+01	1.19E+06	9.15E+01	6.60E-01	2.83E-08	6.30E+07	1.79E+00
	8.78E+05			6.27E+02				1.72E+05		1.10E+04		3.69E-04		9.77E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.72E+07	5.00E+02	4.88E+06
5.00E+01	8.61E+06	2.50E+02	2.44E+06
1.00E+03	1.72E+08	5.00E+03	4.88E+07

X/Q = 9.24E-05 s/m^3

Monitor efficiencies from ERS-SFL-85-031 — Upstream filtration (iodines reduced 0.01) — Release (uCi/s) CF for TEDE = 7.15E+05 (Expression 5)

VS-107B Victoreen — Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s — Release (uCi/s) CF for Child Thyroid = 3.95E+04 (Expression 5)

Isotope	U1 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-08	4.69E-01	1.07E-05	1.63E+01	6.99E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.98E-01	3.86E-08	0.00E+00	0.00E+00
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.71E+01	2.88E-06	5.16E+07	1.49E+02	0.00E+00	0.00E+00	3.71E+00	1.59E-07	5.16E+07	8.22E+00
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.97E+05	1.70E-02	5.04E+07	8.59E+05	0.00E+00	0.00E+00	2.19E+04	9.42E-04	5.04E+07	4.75E+04
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	8.54E+00	3.67E-07	9.61E+07	3.52E+01	0.00E+00	0.00E+00	4.72E-01	2.03E-08	9.61E+07	1.95E+00
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	7.30E+01	3.14E-06	5.16E+07	1.62E+02	0.00E+00	0.00E+00	4.03E+00	1.73E-07	5.16E+07	8.95E+00
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.54E-04	1.52E-11	9.59E+07	1.46E-03	0.00E+00	0.00E+00	1.96E-05	8.41E-13	9.59E+07	8.07E-05
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.43E+04	6.15E-04	2.94E+07	1.81E+04	0.00E+00	0.00E+00	7.91E+02	3.40E-05	2.94E+07	9.99E+02
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	2.20E+03	9.44E-05	4.17E+07	3.83E+03	0.00E+00	0.00E+00	1.21E+02	5.21E-06	4.17E+07	2.17E+02
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	3.01E+05	1.29E-02	2.29E+07	2.95E+06	0.00E+00	0.00E+00	1.66E+04	7.14E-04	2.29E+07	1.63E+04
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.47E+02	6.31E-06	1.51E+07	9.51E+01	0.00E+00	0.00E+00	8.11E+00	3.48E-07	1.51E+07	5.25E+00
Xe-135	1.66E-02	3.16E-04	1.25E+03	3.95E-01	2.26E+02	9.70E-06	6.42E+07	6.23E+02	0.00E+00	0.00E+00	1.25E+01	5.36E-07	6.42E+07	3.44E+01
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.44E-03	6.20E-11	1.05E+08	6.53E-03	0.00E+00	0.00E+00	7.97E-05	3.43E-12	1.05E+08	3.61E-04
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.60E-01	6.88E-09	7.35E+07	5.06E-01	0.00E+00	0.00E+00	8.85E-03	3.80E-10	7.35E+07	2.80E-02
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	6.56E+01	2.82E-06	4.41E+07	1.24E+02	2.44E+07	2.24E+03	3.63E+00	1.56E-07	4.41E+07	6.87E+00
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	4.39E+01	1.89E-06	7.31E+07	1.38E+02	2.90E+05	1.78E+01	2.43E+00	1.04E-07	7.31E+07	7.62E+00
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.67E+01	7.19E-07	6.89E+07	4.96E+01	5.77E+06	1.35E+02	9.25E-01	3.97E-08	6.89E+07	2.74E+00
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	4.38E-01	1.88E-08	8.06E+07	1.52E+00	7.60E+04	4.66E-02	2.42E-02	1.04E-09	8.06E+07	8.38E-02
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.56E+00	1.96E-07	6.30E+07	1.24E+01	1.19E+06	7.59E+00	2.52E-01	1.08E-08	6.30E+07	6.83E-01
	5.89E+01			1.33E+02				1.18E+06		2.40E+03		1.70E-03		6.51E+04

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.18E+08	5.00E+02	3.25E+07
5.00E+01	5.89E+07	2.50E+02	1.63E+07
1.00E+03	1.18E+09	5.00E+03	3.25E+08

X/Q = 9.24E-05 s/m^3

Monitor efficiencies from ERS-SFL-85-031 — Pre-release iodine mitigation in ERS-MPD-01-002 (Iodines reduced 0.005) — Release (uCi/s) CF for TEDE = 2.26E+04 (Expression 5)

VS-107B Victoreen — Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s — Release (uCi/s) CF for Child Thyroid = 4.50E+03 (Expression 5)

Isotope	U1 only LOCA TID (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.96E+02	1.27E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.88E+01	2.53E-06	0.00E+00	0.00E+00
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	6.10E+02	2.62E-05	5.16E+07	1.35E+03	0.00E+00	0.00E+00	1.21E+02	5.21E-06	5.16E+07	2.69E+02
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.59E+01	1.11E-06	5.04E+07	5.60E+01	0.00E+00	0.00E+00	5.14E+00	2.21E-07	5.04E+07	1.11E+01
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.22E+03	5.25E-05	9.61E+07	5.05E+03	0.00E+00	0.00E+00	2.43E+02	1.04E-05	9.61E+07	1.00E+03
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.70E+03	7.29E-05	5.16E+07	3.77E+03	0.00E+00	0.00E+00	3.38E+02	1.45E-05	5.16E+07	7.49E+02
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	2.11E+03	9.07E-05	9.59E+07	8.70E+03	0.00E+00	0.00E+00	4.20E+02	1.80E-05	9.59E+07	1.73E+03
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.38E+01	1.45E-06	2.94E+07	4.26E+01	0.00E+00	0.00E+00	6.72E+00	2.89E-07	2.94E+07	8.48E+00
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.58E+02	6.78E-06	4.17E+07	2.83E+02	0.00E+00	0.00E+00	3.14E+01	1.35E-06	4.17E+07	5.63E+01
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	5.00E+03	2.15E-04	2.29E+07	4.91E+03	0.00E+00	0.00E+00	9.95E+02	4.28E-05	2.29E+07	9.77E+02
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	1.05E+03	4.51E-05	1.51E+07	6.80E+02	0.00E+00	0.00E+00	2.09E+02	8.98E-06	1.51E+07	1.35E+02
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.51E+03	6.50E-05	6.42E+07	4.18E+03	0.00E+00	0.00E+00	3.01E+02	1.29E-05	6.42E+07	8.31E+02
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.56E+03	1.96E-04	1.05E+08	2.06E+04	0.00E+00	0.00E+00	9.08E+02	3.90E-05	1.05E+08	4.10E+03
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	4.25E+03	1.83E-04	7.35E+07	1.34E+04	0.00E+00	0.00E+00	8.46E+02	3.63E-05	7.35E+07	2.67E+03
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.22E+01	5.23E-07	4.41E+07	2.30E+01	2.44E+07	1.31E+04	2.42E+00	1.04E-07	4.41E+07	4.58E+00
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.78E+01	7.66E-07	7.31E+07	5.60E+01	2.90E+05	2.28E+02	3.54E+00	1.52E-07	7.31E+07	1.11E+01
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.50E+01	1.07E-06	6.89E+07	7.41E+01	5.77E+06	6.37E+03	4.98E+00	2.14E-07	6.89E+07	1.47E+01
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.77E+01	1.19E-06	8.06E+07	9.59E+01	7.60E+04	9.29E+01	5.50E+00	2.37E-07	8.06E+07	1.91E+01
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.38E+01	1.02E-06	6.30E+07	6.44E+01	1.19E+06	1.25E+03	4.73E+00	2.03E-07	6.30E+07	1.28E+01
	7.24E+08			4.19E+03				6.34E+04		2.10E+04		1.94E-04		1.26E+04

TEDE	cpm	Child Thyroid	cpm
1.00E+02	6.34E+06	5.00E+02	6.31E+06
5.00E+01	3.17E+06	2.50E+02	3.15E+06
1.00E+03	6.34E+07	5.00E+03	6.31E+07

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 1.05E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.05E+04 (Expression 5)

Monitor efficiencies from ERS-SFL-85-031
VS-107B Victoreen

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

Isotope	U1 only SB LOCA (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	6.51E+01	2.80E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.54E+00	2.81E-07	0.00E+00	0.00E+00
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.33E+02	1.00E-05	5.16E+07	5.16E+02	0.00E+00	0.00E+00	2.34E+01	1.01E-06	5.16E+07	5.19E+01
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	2.07E+04	8.88E-04	5.04E+07	4.47E+04	0.00E+00	0.00E+00	2.08E+03	8.92E-05	5.04E+07	4.50E+03
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.47E+02	6.34E-06	9.61E+07	6.09E+02	0.00E+00	0.00E+00	1.48E+01	6.37E-07	9.61E+07	6.12E+01
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	4.29E+02	1.84E-05	5.16E+07	9.51E+02	0.00E+00	0.00E+00	4.31E+01	1.85E-06	5.16E+07	9.56E+01
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.77E+00	1.62E-07	9.59E+07	1.55E+01	0.00E+00	0.00E+00	3.78E-01	1.63E-08	9.59E+07	1.56E+00
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	8.79E+02	3.78E-05	2.94E+07	1.11E+03	0.00E+00	0.00E+00	8.83E+01	3.79E-06	2.94E+07	1.12E+02
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.87E+02	3.38E-05	4.17E+07	1.41E+03	0.00E+00	0.00E+00	7.91E+01	3.40E-06	4.17E+07	1.42E+02
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	5.28E+04	2.27E-03	2.29E+07	5.19E+04	0.00E+00	0.00E+00	5.31E+03	2.28E-04	2.29E+07	5.21E+03
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.33E+04	1.00E-03	1.51E+07	1.51E+04	0.00E+00	0.00E+00	2.34E+03	1.01E-04	1.51E+07	1.52E+03
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	5.23E+03	2.25E-04	6.42E+07	1.44E+04	0.00E+00	0.00E+00	5.26E+02	2.26E-05	6.42E+07	1.45E+03
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.14E+01	4.90E-07	1.05E+08	5.15E+01	0.00E+00	0.00E+00	1.15E+00	4.92E-08	1.05E+08	5.18E+00
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.92E+01	3.40E-06	7.35E+07	2.50E+02	0.00E+00	0.00E+00	7.96E+00	3.42E-07	7.35E+07	2.52E+01
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.59E+01	1.11E-06	4.41E+07	4.91E+01	2.44E+07	6.04E+03	2.61E+00	1.12E-07	4.41E+07	4.94E+00
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.67E+01	1.15E-06	7.31E+07	8.38E+01	2.90E+05	7.38E+01	2.68E+00	1.15E-07	7.31E+07	8.42E+00
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.50E+01	1.93E-06	6.89E+07	1.33E+02	5.77E+06	2.48E+03	4.52E+00	1.94E-07	6.89E+07	1.34E+01
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	3.09E+01	1.33E-06	8.06E+07	1.07E+02	7.60E+04	2.24E+01	3.10E+00	1.33E-07	8.06E+07	1.07E+01
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.43E+01	1.47E-06	6.30E+07	9.28E+01	1.19E+06	3.89E+02	3.44E+00	1.48E-07	6.30E+07	9.33E+00
	4.01E+02			9.05E+02				1.32E+05		9.00E+03		4.53E-04		1.32E+04

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.32E+07	5.00E+02	6.61E+06
5.00E+01	6.58E+06	2.50E+02	3.30E+06
1.00E+03	1.32E+08	5.00E+03	6.61E+07

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 5.24E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.48E+05 (Expression 5)

Monitor efficiencies from ERS-SFL-85-031
VS-107B Victoreen

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 4.93E+04 cfm : 2.33E+07 cc/s

Isotope	U1 & U2 FHA (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	4.69E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85m	1.04E-03	3.07E-08	8.17E+02	2.50E-05	1.61E-02	6.90E-10	5.16E+07	3.56E-02	0.00E+00	0.00E+00	7.61E-03	3.27E-10	5.16E+07	1.69E-02
Kr-85	4.78E+02	1.41E-02	1.12E+01	1.58E-01	7.38E+03	3.17E-04	5.04E+07	1.60E+04	0.00E+00	0.00E+00	3.50E+03	1.50E-04	5.04E+07	7.58E+03
Kr-87	0.00E+00	0.00E+00	4.47E+03	0.00E+00	0.00E+00	0.00E+00	9.61E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.61E+07	0.00E+00
Kr-88	0.00E+00	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	5.16E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.16E+07	0.00E+00
Kr-89	0.00E+00	0.00E+00	1.02E+04	0.00E+00	0.00E+00	0.00E+00	9.59E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.59E+07	0.00E+00
Xe-131m	4.66E+02	1.37E-02	4.29E+01	5.89E-01	7.19E+03	3.09E-04	2.94E+07	9.09E+03	0.00E+00	0.00E+00	3.41E+03	1.47E-04	2.94E+07	4.31E+03
Xe-133m	6.16E+02	1.82E-02	1.49E+02	2.71E+00	9.51E+03	4.09E-04	4.17E+07	1.70E+04	0.00E+00	0.00E+00	4.51E+03	1.94E-04	4.17E+07	8.07E+03
Xe-133	3.23E+04	9.52E-01	1.76E+02	1.68E+02	4.99E+05	2.14E-02	2.29E+07	4.90E+05	0.00E+00	0.00E+00	2.36E+05	1.02E-02	2.29E+07	2.32E+05
Xe-135m	2.65E+00	7.81E-05	2.15E+03	1.68E-01	4.09E+01	1.76E-06	1.51E+07	2.65E+01	0.00E+00	0.00E+00	1.94E+01	8.33E-07	1.51E+07	1.26E+01
Xe-135	6.10E+01	1.80E-03	1.25E+03	2.25E+00	9.42E+02	4.05E-05	6.42E+07	2.60E+03	0.00E+00	0.00E+00	4.46E+02	1.92E-05	6.42E+07	1.23E+03
Xe-137	0.00E+00	0.00E+00	9.55E+02	0.00E+00	0.00E+00	0.00E+00	1.05E+08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.05E+08	0.00E+00
Xe-138	0.00E+00	0.00E+00	6.27E+03	0.00E+00	0.00E+00	0.00E+00	7.35E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.35E+07	0.00E+00
I-131	5.20E-01	1.53E-05	4.66E+05	7.14E+00	8.03E+00	3.45E-07	4.41E+07	1.52E+01	2.44E+07	3.74E+02	3.81E+00	1.64E-07	4.41E+07	7.21E+00
I-132	2.52E-01	7.43E-06	4.33E+04	3.22E-01	3.88E+00	1.67E-07	7.31E+07	1.22E+01	2.90E+05	2.15E+00	1.84E+00	7.93E-08	7.31E+07	5.79E+00
I-133	3.35E-02	9.87E-07	1.28E+05	1.26E-01	5.17E-01	2.22E-08	6.89E+07	1.53E+00	5.77E+06	5.70E+00	2.45E-01	1.05E-08	6.89E+07	7.26E-01
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	8.06E+07	0.00E+00	7.60E+04	0.00E+00	0.00E+00	0.00E+00	8.06E+07	0.00E+00
I-135	2.23E-05	6.57E-10	7.10E+04	4.67E-05	3.44E-04	1.48E-11	6.30E+07	9.32E-04	1.19E+06	7.82E-04	1.63E-04	7.01E-12	6.30E+07	4.42E-04
	3.39E+04			1.81E+02				5.34E+05		3.82E+02		1.07E-02		2.53E+05

TEDE	cpm	Child Thyroid	cpm
1.00E+02	5.34E+07	5.00E+02	1.27E+08
5.00E+01	2.67E+07	2.50E+02	6.33E+07
1.00E+03	5.34E+08	5.00E+03	1.27E+09

Monitor efficiencies from ERS-SFL-85-031   Upstream filtration (iodines reduced 0.01)   X/Q = 9.240E-05 s/m³

Release (uCi/s) CF for TEDE = 2.202E+05 (Expression 5)

VS-107B Victoreen   Release Flow Rate = 4.93E+04 cfm : 2.327E+07 cc/s   Release (uCi/s) CF for Child Thyroid = 1.216E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	5.45E+02	2.34E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.012E+02	1.295E-05	0.000E+00	0.000E+00
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.30E+03	5.59E-05	5.162E+07	2.888E+03	0.000E+00	0.000E+00	7.192E+02	3.091E-05	5.162E+07	1.595E+03
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	3.17E+03	1.36E-04	5.041E+07	6.864E+03	0.000E+00	0.000E+00	1.751E+03	7.524E-05	5.041E+07	3.793E+03
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	7.45E+02	3.20E-05	9.605E+07	3.075E+03	0.000E+00	0.000E+00	4.117E+02	1.769E-05	9.605E+07	1.699E+03
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.33E+03	1.00E-04	5.162E+07	5.161E+03	0.000E+00	0.000E+00	1.285E+03	5.524E-05	5.162E+07	2.852E+03
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	5.37E+01	2.31E-06	9.592E+07	2.212E+02	0.000E+00	0.000E+00	2.965E+01	1.274E-06	9.592E+07	1.222E+02
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.65E+03	1.14E-04	2.939E+07	3.353E+03	0.000E+00	0.000E+00	1.467E+03	6.304E-05	2.939E+07	1.853E+03
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	3.18E+03	1.37E-04	4.168E+07	5.701E+03	0.000E+00	0.000E+00	1.759E+03	7.558E-05	4.168E+07	3.150E+03
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.88E+05	8.10E-03	2.285E+07	1.850E+05	0.000E+00	0.000E+00	1.041E+05	4.474E-03	2.285E+07	1.022E+05
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	2.03E+03	8.71E-05	1.507E+07	1.313E+03	0.000E+00	0.000E+00	1.120E+03	4.812E-05	1.507E+07	7.252E+02
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.51E+04	6.50E-04	6.422E+07	4.175E+04	0.000E+00	0.000E+00	8.359E+03	3.592E-04	6.422E+07	2.307E+04
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.38E+02	5.94E-06	1.052E+08	6.246E+02	0.000E+00	0.000E+00	7.634E+01	3.281E-06	1.052E+08	3.451E+02
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.82E+02	2.07E-05	7.353E+07	1.524E+03	0.000E+00	0.000E+00	2.666E+02	1.145E-05	7.353E+07	8.423E+02
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	6.47E+00	2.78E-07	4.407E+07	1.224E+01	2.440E+07	7.166E+02	3.572E+00	1.535E-07	4.407E+07	6.766E+00
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.23E-01	9.57E-09	7.309E+07	6.994E-01	2.900E+05	2.933E-01	1.230E-01	5.287E-09	7.309E+07	3.864E-01
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	2.21E+00	9.51E-08	6.894E+07	6.554E+00	5.770E+06	5.798E+01	1.222E+00	5.253E-08	6.894E+07	3.621E+00
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.33E-01	5.70E-09	8.064E+07	4.595E-01	7.600E+04	4.577E-02	7.326E-02	3.148E-09	8.064E+07	2.539E-01
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	8.28E-01	3.56E-08	6.303E+07	2.242E+00	1.190E+06	4.474E+00	4.574E-01	1.966E-08	6.303E+07	1.239E+00
	1.54E+04			4.31E+02				2.575E+05		7.793E+02		5.228E-03		1.423E+05

TEDE	cpm	Child Thyroid	cpm
100	2.58E+07	500	7.11E+07
50	1.29E+07	250	3.56E+07
1000	2.58E+08	5000	7.11E+08

Monitor efficiencies from ERS-SFL-85-031
SPING GW-109 Channel 7

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 1.45E+03 cfm : 6.84E+05 cc/s

X/Q = 2.31E-06 s/m³
Release (uCi/s) CF for TEDE = 8.71E+06 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.28E+06 (Expression 5)

Isotope	U1 SGTR (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.09E+00	7.56E-04	4.69E-01	3.55E-04	6.59E+03	9.62E-03	2.06E+01	1.98E-01	0.00E+00	0.00E+00	1.73E+03	2.52E-03	2.06E+01	5.20E-02
Kr-85m	7.35E+00	2.66E-03	8.17E+02	2.17E+00	2.32E+04	3.38E-02	1.25E+03	4.23E+01	0.00E+00	0.00E+00	6.07E+03	8.88E-03	1.25E+03	1.11E+01
Kr-85	6.74E+02	2.44E-01	1.12E+01	2.73E+00	2.12E+06	3.10E+00	2.18E+01	6.76E+01	0.00E+00	0.00E+00	5.57E+05	8.14E-01	2.18E+01	1.77E+01
Kr-87	4.48E+00	1.62E-03	4.47E+03	7.24E+00	1.41E+04	2.06E-02	6.29E+03	1.30E+02	0.00E+00	0.00E+00	3.70E+03	5.41E-03	6.29E+03	3.40E+01
Kr-88	1.34E+01	4.85E-03	1.13E+04	5.48E+01	4.22E+04	6.17E-02	1.55E+04	9.56E+02	0.00E+00	0.00E+00	1.11E+04	1.62E-02	1.55E+04	2.51E+02
Kr-89	7.66E-02	2.77E-05	1.02E+04	2.83E-01	2.41E+02	3.53E-04	1.46E+04	5.13E+00	0.00E+00	0.00E+00	6.33E+01	9.25E-05	1.46E+04	1.35E+00
Xe-131m	2.76E+01	9.98E-03	4.29E+01	4.28E-01	8.70E+04	1.27E-01	1.59E+02	2.03E+01	0.00E+00	0.00E+00	2.28E+04	3.33E-02	1.59E+02	5.31E+00
Xe-133m	2.34E+01	8.46E-03	1.49E+02	1.26E+00	7.37E+04	1.08E-01	3.29E+02	3.55E+01	0.00E+00	0.00E+00	1.93E+04	2.83E-02	3.29E+02	9.30E+00
Xe-133	1.69E+03	6.11E-01	1.76E+02	1.08E+02	5.33E+06	7.78E+00	3.00E+02	2.33E+03	0.00E+00	0.00E+00	1.40E+06	2.04E+00	3.00E+02	6.11E+02
Xe-135m	2.27E+02	8.21E-02	2.15E+03	1.77E+02	7.15E+05	1.05E+00	3.42E+03	3.57E+03	0.00E+00	0.00E+00	1.88E+05	2.74E-01	3.42E+03	9.36E+02
Xe-135	9.28E+01	3.36E-02	1.25E+03	4.20E+01	2.92E+05	4.27E-01	1.97E+03	8.40E+02	0.00E+00	0.00E+00	7.67E+04	1.12E-01	1.97E+03	2.20E+02
Xe-137	2.33E-01	8.43E-05	9.55E+02	8.05E-02	7.34E+02	1.07E-03	1.49E+03	1.60E+00	0.00E+00	0.00E+00	1.93E+02	2.81E-04	1.49E+03	4.19E-01
Xe-138	1.99E+00	7.20E-04	6.27E+03	4.51E+00	6.27E+03	9.16E-03	8.93E+03	8.18E+01	0.00E+00	0.00E+00	1.64E+03	2.40E-03	8.93E+03	2.15E+01
I-131	1.35E-01	4.88E-05	4.66E+05	2.28E+01	4.26E+02	6.22E-04	1.51E+02	9.39E-02	2.44E+07	1.19E+03	1.12E+02	1.63E-04	1.51E+02	2.46E-02
I-132	4.77E-02	1.73E-05	4.33E+04	7.47E-01	1.50E+02	2.20E-04	9.09E+02	2.00E-01	2.90E+05	5.00E+00	3.94E+01	5.76E-05	9.09E+02	5.23E-02
I-133	1.99E-01	7.20E-05	1.28E+05	9.21E+00	6.27E+02	9.16E-04	2.41E+02	2.20E-01	5.77E+06	4.15E+02	1.64E+02	2.40E-04	2.41E+02	5.76E-02
I-134	2.33E-02	8.43E-06	2.69E+04	2.27E-01	7.34E+01	1.07E-04	1.04E+03	1.12E-01	7.60E+04	6.40E-01	1.93E+01	2.81E-05	1.04E+03	2.93E-02
I-135	1.10E-01	3.98E-05	7.10E+04	2.62E+00	3.47E+02	5.08E-04	6.25E+02	3.16E-01	1.19E+06	4.73E+01	9.09E+01	1.33E-04	6.25E+02	8.29E-02
	2.78E+03			4.35E+02				8.08E+03		1.66E+03		3.34E+00		2.12E+03

TEDE	cpm	Child Thyroid	cpm
1.00E+02	8.08E+05	5.00E+02	1.06E+06
5.00E+01	4.04E+05	2.50E+02	5.30E+05
1.00E+03	8.08E+06	5.00E+03	1.06E+07

Monitor efficiencies from ERS-SFL-85-031
SPING GW-109 Channel 7

Release Flow Rate = 1.45E+03 cfm : 6.84E+05 cc/s

X/Q = 2.31E-06 s/m³
Release (uCi/s) CF for TEDE = 1.56E+07 (Expression 5)
Release (uCi/s) CF for Child Thyroid = #DIV/0! (Expression 5)

Isotope	U1 GW Fail (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.80E+00	1.06E-03	4.69E-01	4.93E-04	1.64E+04	2.40E-02	2.06E+01	4.95E-01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.06E+01	#DIV/0!
Kr-85m	1.17E+01	4.39E-03	8.17E+02	3.59E+00	6.86E+04	1.00E-01	1.25E+03	1.25E+02	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.25E+03	#DIV/0!
Kr-85	1.16E+03	4.36E-01	1.12E+01	4.88E+00	6.81E+06	9.94E+00	2.18E+01	2.17E+02	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.18E+01	#DIV/0!
Kr-87	5.89E+00	2.21E-03	4.47E+03	9.88E+00	3.46E+04	5.05E-02	6.29E+03	3.18E+02	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	6.29E+03	#DIV/0!
Kr-88	2.03E+01	7.62E-03	1.13E+04	8.61E+01	1.19E+05	1.74E-01	1.55E+04	2.70E+03	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.55E+04	#DIV/0!
Kr-89	2.12E-01	7.96E-05	1.02E+04	8.12E-01	1.24E+03	1.82E-03	1.46E+04	2.64E+01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.46E+04	#DIV/0!
Xe-131m	1.77E+01	6.65E-03	4.29E+01	2.85E-01	1.04E+05	1.52E-01	1.59E+02	2.42E+01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.59E+02	#DIV/0!
Xe-133m	2.45E+01	9.20E-03	1.49E+02	1.37E+00	1.44E+05	2.10E-01	3.29E+02	6.91E+01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.29E+02	#DIV/0!
Xe-133	1.33E+03	4.99E-01	1.76E+02	8.79E+01	7.80E+06	1.14E+01	3.00E+02	3.42E+03	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.00E+02	#DIV/0!
Xe-135m	3.38E+00	1.27E-03	2.15E+03	2.73E+00	1.98E+04	2.90E-02	3.42E+03	9.89E+01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.42E+03	#DIV/0!
Xe-135	8.41E+01	3.16E-02	1.25E+03	3.95E+01	4.93E+05	7.21E-01	1.97E+03	1.42E+03	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.97E+03	#DIV/0!
Xe-137	5.59E-01	2.10E-04	9.55E+02	2.00E-01	3.28E+03	4.79E-03	1.49E+03	7.13E+00	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.49E+03	#DIV/0!
Xe-138	2.32E+00	8.71E-04	6.27E+03	5.46E+00	1.36E+04	1.99E-02	8.93E+03	1.78E+02	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	8.93E+03	#DIV/0!
I-131	0.00E+00	0.00E+00	4.66E+05	0.00E+00	0.00E+00	0.00E+00	1.51E+02	0.00E+00	2.44E+07	0.00E+00	#DIV/0!	#DIV/0!	1.51E+02	#DIV/0!
I-132	0.00E+00	0.00E+00	4.33E+04	0.00E+00	0.00E+00	0.00E+00	9.09E+02	0.00E+00	2.90E+05	0.00E+00	#DIV/0!	#DIV/0!	9.09E+02	#DIV/0!
I-133	0.00E+00	0.00E+00	1.28E+05	0.00E+00	0.00E+00	0.00E+00	2.41E+02	0.00E+00	5.77E+06	0.00E+00	#DIV/0!	#DIV/0!	2.41E+02	#DIV/0!
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	1.04E+03	0.00E+00	7.60E+04	0.00E+00	#DIV/0!	#DIV/0!	1.04E+03	#DIV/0!
I-135	0.00E+00	0.00E+00	7.10E+04	0.00E+00	0.00E+00	0.00E+00	6.25E+02	0.00E+00	1.19E+06	0.00E+00	#DIV/0!	#DIV/0!	6.25E+02	#DIV/0!
	2.66E+03			2.43E+02				8.59E+03		0.00E+00		#DIV/0!		#DIV/0!

TEDE	cpm	Child Thyroid	cpm
1.00E+02	8.59E+05	5.00E+02	#DIV/0!
5.00E+01	4.30E+05	2.50E+02	#DIV/0!
1.00E+03	8.59E+06	5.00E+03	#DIV/0!

Monitor efficiencies from ERS-SFL-85-031 Upstream filtration (Iodines reduced 0.01)
SPING GW-109 Channel 9 Release Flow Rate = 1.45E+03 cfm 6.84E+05 cc/s

X/Q = 2.31E-06 s/m³
Release (uCi/s) CF for TEDE = 8.71E+06 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.28E+06 (Expression 5)

Isotope	U1 SGTR (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.09E+00	7.56E-04	4.69E-01	3.55E-04	6.59E+03	9.62E-03	4.99E-01	4.80E-03	0.00E+00	0.00E+00	1.73E+03	2.52E-03	4.99E-01	1.26E-03
Kr-85m	7.35E+00	2.66E-03	8.17E+02	2.17E+00	2.32E+04	3.38E-02	3.03E+01	1.02E+00	0.00E+00	0.00E+00	6.07E+03	8.88E-03	3.03E+01	2.69E-01
Kr-85	6.74E+02	2.44E-01	1.12E+01	2.73E+00	2.12E+06	3.10E+00	1.11E+00	3.45E+00	0.00E+00	0.00E+00	5.57E+05	8.14E-01	1.11E+00	9.06E-01
Kr-87	4.48E+00	1.62E-03	4.47E+03	7.24E+00	1.41E+04	2.06E-02	1.52E+02	3.14E+00	0.00E+00	0.00E+00	3.70E+03	5.41E-03	1.52E+02	8.24E-01
Kr-88	1.34E+01	4.85E-03	1.13E+04	5.48E+01	4.22E+04	6.17E-02	3.75E+02	2.32E+01	0.00E+00	0.00E+00	1.11E+04	1.62E-02	3.75E+02	6.07E+00
Kr-89	7.66E-02	2.77E-05	1.02E+04	2.83E-01	2.41E+02	3.53E-04	3.52E+02	1.24E-01	0.00E+00	0.00E+00	6.33E+01	9.25E-05	3.52E+02	3.26E-02
Xe-131m	2.76E+01	9.98E-03	4.29E+01	4.28E-01	8.70E+04	1.27E-01	3.86E+00	4.90E-01	0.00E+00	0.00E+00	2.28E+04	3.33E-02	3.86E+00	1.29E-01
Xe-133m	2.34E+01	8.46E-03	1.49E+02	1.26E+00	7.37E+04	1.08E-01	7.97E+00	8.58E-01	0.00E+00	0.00E+00	1.93E+04	2.83E-02	7.97E+00	2.26E-01
Xe-133	1.69E+03	6.11E-01	1.76E+02	1.08E+02	5.33E+06	7.78E+00	3.95E+00	3.08E+01	0.00E+00	0.00E+00	1.40E+06	2.04E+00	3.95E+00	8.07E+00
Xe-135m	2.27E+02	8.21E-02	2.15E+03	1.77E+02	7.15E+05	1.05E+00	8.27E+01	8.64E+01	0.00E+00	0.00E+00	1.88E+05	2.74E-01	8.27E+01	2.27E+01
Xe-135	9.26E+01	3.36E-02	1.25E+03	4.20E+01	2.92E+05	4.27E-01	4.76E+01	2.03E+01	0.00E+00	0.00E+00	7.67E+04	1.12E-01	4.76E+01	5.33E+00
Xe-137	2.33E-01	8.43E-05	9.55E+02	8.06E-02	7.34E+02	1.07E-03	3.60E+01	3.87E-02	0.00E+00	0.00E+00	1.93E+02	2.81E-04	3.60E+01	1.01E-02
Xe-138	1.99E+00	7.20E-04	6.27E+03	4.51E+00	6.27E+03	9.16E-03	2.16E+02	1.98E+00	0.00E+00	0.00E+00	1.64E+03	2.40E-03	2.16E+02	5.19E-01
I-131	1.35E-01	4.88E-05	4.66E+05	2.28E+01	4.25E+02	6.22E-04	3.66E+00	2.27E-03	2.44E+07	1.19E+03	1.12E+02	1.63E-04	3.66E+00	5.96E-04
I-132	4.77E-02	1.73E-05	4.33E+04	7.47E-01	1.50E+02	2.20E-04	2.20E+01	4.83E-03	2.90E+05	5.00E+00	3.94E+01	5.76E-05	2.20E+01	1.27E-03
I-133	1.99E-01	7.20E-05	1.28E+05	9.21E+00	6.27E+02	9.16E-04	5.82E+00	5.34E-03	5.77E+06	4.15E+02	1.64E+02	2.40E-04	5.82E+00	1.40E-03
I-134	2.33E-02	8.43E-06	2.69E+04	2.27E-01	7.34E+01	1.07E-04	2.52E+01	2.70E-03	7.60E+04	6.40E-01	1.93E+01	2.81E-06	2.52E+01	7.09E-04
I-135	1.10E-01	3.98E-05	7.10E+04	2.82E+00	3.47E+02	5.06E-04	1.51E+01	7.66E-03	1.19E+06	4.73E+01	9.09E+01	1.33E-04	1.51E+01	2.01E-03
	2.76E+03			4.35E+02				1.72E+02		1.66E+03		3.34E+00		4.51E+01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.72E+04	5.00E+02	2.25E+04
5.00E+01	8.59E+03	2.50E+02	1.13E+04
1.00E+03	1.72E+05	5.00E+03	2.25E+05

X/Q = 2.31E-06 s/m³
Release (uCi/s) CF for TEDE = 1.56E+07 (Expression 5)
Release (uCi/s) CF for Child Thyroid = #DIV/0! (Expression 5)

Monitor efficiencies from ERS-SFL-85-031
SPING GW-109 Channel 9 Release Flow Rate = 1.45E+03 cfm 6.84E+05 cc/s

Isotope	U1 GW Fail (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.80E+00	1.05E-03	4.69E-01	4.93E-04	1.64E+04	2.40E-02	4.99E-01	1.20E-02	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	4.99E-01	#DIV/0!
Kr-85m	1.17E+01	4.39E-03	8.17E+02	3.59E+00	6.86E+04	1.00E-01	3.03E+01	3.04E+00	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.03E+01	#DIV/0!
Kr-85	1.16E+03	4.36E-01	1.12E+01	4.88E+00	6.81E+06	9.94E+00	1.11E+00	1.11E+01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.11E+00	#DIV/0!
Kr-87	5.89E+00	2.21E-03	4.47E+03	9.88E+00	3.46E+04	5.05E-02	1.52E+02	7.69E+00	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.52E+02	#DIV/0!
Kr-88	2.03E+01	7.62E-03	1.13E+04	8.61E+01	1.19E+05	1.74E-01	3.75E+02	6.53E+01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.75E+02	#DIV/0!
Kr-89	2.12E-01	7.96E-05	1.02E+04	8.12E-01	1.24E+03	1.82E-03	3.52E+02	6.40E-01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.52E+02	#DIV/0!
Xe-131m	1.77E+01	6.65E-03	4.29E+01	2.85E-01	1.04E+05	1.52E-01	3.86E+00	5.86E-01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.86E+00	#DIV/0!
Xe-133m	2.45E+01	9.20E-03	1.49E+02	1.37E+00	1.44E+05	2.10E-01	7.97E+00	1.67E+00	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	7.97E+00	#DIV/0!
Xe-133	1.33E+03	4.99E-01	1.76E+02	8.79E+01	7.80E+06	1.14E+01	3.95E+00	4.51E+01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.95E+00	#DIV/0!
Xe-135m	3.38E+00	1.27E-03	2.15E+03	2.73E+00	1.98E+04	2.90E-02	8.27E+01	2.40E+00	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	8.27E+01	#DIV/0!
Xe-135	8.41E+01	3.16E-02	1.25E+03	3.95E+01	4.93E+05	7.21E-01	4.76E+01	3.43E+01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	4.76E+01	#DIV/0!
Xe-137	5.59E-01	2.10E-04	9.55E+02	2.00E-01	3.28E+03	4.79E-03	3.60E+01	1.73E-01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.60E+01	#DIV/0!
Xe-138	2.32E+00	8.71E-04	6.27E+03	5.46E+00	1.36E+04	1.99E-02	2.16E+02	4.30E+00	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.16E+02	#DIV/0!
I-131	0.00E+00	0.00E+00	4.66E+05	0.00E+00	0.00E+00	0.00E+00	3.66E+00	0.00E+00	2.44E+07	0.00E+00	#DIV/0!	#DIV/0!	3.66E+00	#DIV/0!
I-132	0.00E+00	0.00E+00	4.33E+04	0.00E+00	0.00E+00	0.00E+00	2.20E+01	0.00E+00	2.90E+05	0.00E+00	#DIV/0!	#DIV/0!	2.20E+01	#DIV/0!
I-133	0.00E+00	0.00E+00	1.28E+05	0.00E+00	0.00E+00	0.00E+00	5.82E+00	0.00E+00	5.77E+06	0.00E+00	#DIV/0!	#DIV/0!	5.82E+00	#DIV/0!
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	2.52E+01	0.00E+00	7.60E+04	0.00E+00	#DIV/0!	#DIV/0!	2.52E+01	#DIV/0!
I-135	0.00E+00	0.00E+00	7.10E+04	0.00E+00	0.00E+00	0.00E+00	1.51E+01	0.00E+00	1.19E+06	0.00E+00	#DIV/0!	#DIV/0!	1.51E+01	#DIV/0!
	2.66E+03			2.43E+02				1.76E+02		0.00E+00		#DIV/0!		#DIV/0!

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.76E+04	5.00E+02	#DIV/0!
5.00E+01	8.81E+03	2.50E+02	#DIV/0!
1.00E+03	1.76E+05	5.00E+03	#DIV/0!

X/Q = 2.31E-06 s/m^3

Monitor efficiencies from ERS-SFL-85-031 | Upstream filtration (iodines reduced 0.01) | Release (uCi/s) CF for TEDE = 8.71E+06 (Expression 5)

GW-110 LR SA10 | Release Flow Rate = 1.45E+03 cfm : 6.84E+05 cc/s | Release (uCi/s) CF for Child Thyroid = 2.28E+08 (Expression 5)

Isotope	U1 SGTR (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.09E+00	7.56E-04	4.69E-01	3.55E-04	6.59E+03	9.62E-03	2.88E+03	2.77E+01	0.00E+00	0.00E+00	1.73E+03	2.52E-03	2.88E+03	7.26E+00
Kr-85m	7.35E+00	2.66E-03	8.17E+02	2.17E+00	2.32E+04	3.38E-02	1.74E+05	5.90E+03	0.00E+00	0.00E+00	6.07E+03	8.88E-03	1.74E+05	1.55E+03
Kr-85	6.74E+02	2.44E-01	1.12E+01	2.73E+00	2.12E+06	3.10E+00	2.97E+03	9.21E+03	0.00E+00	0.00E+00	5.57E+05	8.14E-01	2.97E+03	2.42E+03
Kr-87	4.48E+00	1.62E-03	4.47E+03	7.24E+00	1.41E+04	2.06E-02	8.77E+05	1.81E+04	0.00E+00	0.00E+00	3.70E+03	5.41E-03	8.77E+05	4.75E+03
Kr-88	1.34E+01	4.85E-03	1.13E+04	5.48E+01	4.22E+04	6.17E-02	2.16E+06	1.33E+05	0.00E+00	0.00E+00	1.11E+04	1.62E-02	2.16E+06	3.50E+04
Kr-89	7.66E-02	2.77E-05	1.02E+04	2.83E-01	2.41E+02	3.53E-04	2.03E+06	7.16E+02	0.00E+00	0.00E+00	6.33E+01	9.25E-05	2.03E+06	1.88E+02
Xe-131m	2.76E+01	9.98E-03	4.29E+01	4.28E-01	8.70E+04	1.27E-01	2.22E+04	2.82E+03	0.00E+00	0.00E+00	2.28E+04	3.33E-02	2.22E+04	7.41E+02
Xe-133m	2.34E+01	8.46E-03	1.49E+02	1.26E+00	7.37E+04	1.08E-01	4.95E+04	5.33E+03	0.00E+00	0.00E+00	1.93E+04	2.83E-02	4.95E+04	1.40E+03
Xe-133	1.69E+03	6.11E-01	1.76E+02	1.08E+02	5.33E+06	7.78E+00	3.68E+04	2.87E+05	0.00E+00	0.00E+00	1.40E+06	2.04E+00	3.68E+04	7.52E+04
Xe-135m	2.27E+02	8.21E-02	2.15E+03	1.77E+02	7.15E+05	1.05E+00	4.76E+05	4.98E+05	0.00E+00	0.00E+00	1.88E+05	2.74E-01	4.76E+05	1.31E+05
Xe-135	9.28E+01	3.36E-02	1.25E+03	4.20E+01	2.92E+05	4.27E-01	2.74E+05	1.17E+05	0.00E+00	0.00E+00	7.67E+04	1.12E-01	2.74E+05	3.07E+04
Xe-137	2.33E-01	8.43E-05	9.55E+02	8.05E-02	7.34E+02	1.07E-03	2.08E+05	2.23E+02	0.00E+00	0.00E+00	1.93E+02	2.81E-04	2.08E+05	5.84E+01
Xe-138	1.99E+00	7.20E-04	6.27E+03	4.51E+00	6.27E+03	9.16E-03	1.25E+06	1.14E+04	0.00E+00	0.00E+00	1.64E+03	2.40E-03	1.25E+06	2.99E+03
I-131	1.35E-01	4.88E-05	4.66E+05	2.28E+01	4.25E+02	6.22E-04	2.11E+04	1.31E+01	2.44E+07	1.19E+03	1.12E+02	1.63E-04	2.11E+04	3.44E+00
I-132	4.77E-02	1.73E-05	4.33E+04	7.47E-01	1.50E+02	2.20E-04	1.27E+05	2.78E+01	2.90E+05	5.00E+00	3.94E+01	5.76E-05	1.27E+05	7.30E+00
I-133	1.99E-01	7.20E-05	1.28E+05	9.21E+00	6.27E+02	9.16E-04	3.36E+04	3.07E+01	5.77E+06	4.15E+02	1.64E+02	2.40E-04	3.36E+04	8.06E+00
I-134	2.33E-02	8.43E-06	2.69E+04	2.27E-01	7.34E+01	1.07E-04	1.45E+05	1.66E+01	7.60E+04	6.40E-01	1.93E+01	2.81E-05	1.45E+05	4.09E+00
I-135	1.10E-01	3.98E-05	7.10E+04	2.82E+00	3.47E+02	5.06E-04	8.71E+04	4.41E+01	1.19E+06	4.73E+01	9.09E+01	1.33E-04	8.71E+04	1.16E+01
	2.76E+03			4.35E+02				1.09E+06		1.66E+03		3.34E+00		2.66E+05

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.09E+08	5.00E+02	1.43E+08
5.00E+01	5.44E+07	2.50E+02	7.14E+07
1.00E+03	1.09E+09	5.00E+03	1.43E+09

X/Q = 2.31E-06 s/m^3

Monitor efficiencies from ERS-SFL-85-031 | Release (uCi/s) CF for TEDE = 1.56E+07 (Expression 5)

GW-110 LR SA10 | Release Flow Rate = 1.45E+03 cfm : 6.84E+05 cc/s | Release (uCi/s) CF for Child Thyroid = #DIV/0! (Expression 5)

Isotope	U1 GW Fail (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.80E+00	1.05E-03	4.69E-01	4.93E-04	1.64E+04	2.40E-02	2.88E+03	6.90E+01	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.88E+03	#DIV/0!
Kr-85m	1.17E+01	4.39E-03	8.17E+02	3.59E+00	6.86E+04	1.00E-01	1.74E+05	1.75E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.74E+05	#DIV/0!
Kr-85	1.16E+03	4.36E-01	1.12E+01	4.88E+00	6.81E+06	9.94E+00	2.97E+03	2.95E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.97E+03	#DIV/0!
Kr-87	5.89E+00	2.21E-03	4.47E+03	9.88E+00	3.46E+04	5.05E-02	8.77E+05	4.43E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	8.77E+05	#DIV/0!
Kr-88	2.03E+01	7.62E-03	1.13E+04	8.61E+01	1.19E+05	1.74E-01	2.16E+06	3.76E+05	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.16E+06	#DIV/0!
Kr-89	2.12E-01	7.96E-05	1.02E+04	8.12E-01	1.24E+03	1.82E-03	2.03E+06	3.69E+03	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.03E+06	#DIV/0!
Xe-131m	1.77E+01	6.65E-03	4.29E+01	2.85E-01	1.04E+05	1.52E-01	2.22E+04	3.37E+03	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.22E+04	#DIV/0!
Xe-133m	2.45E+01	9.20E-03	1.49E+02	1.37E+00	1.44E+05	2.10E-01	4.95E+04	1.04E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	4.95E+04	#DIV/0!
Xe-133	1.33E+03	4.99E-01	1.76E+02	8.79E+01	7.80E+06	1.14E+01	3.68E+04	4.20E+05	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.68E+04	#DIV/0!
Xe-135m	3.38E+00	1.27E-03	2.15E+03	2.73E+00	1.98E+04	2.90E-02	4.76E+05	1.38E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	4.76E+05	#DIV/0!
Xe-135	8.41E+01	3.16E-02	1.25E+03	3.95E+01	4.93E+05	7.21E-01	2.74E+05	1.98E+05	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.74E+05	#DIV/0!
Xe-137	5.59E-01	2.10E-04	9.55E+02	2.00E-01	3.28E+03	4.79E-03	2.08E+05	9.95E+02	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.08E+05	#DIV/0!
Xe-138	2.32E+00	8.71E-04	6.27E+03	5.46E+00	1.36E+04	1.99E-02	1.25E+06	2.48E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.25E+06	#DIV/0!
I-131	0.00E+00	0.00E+00	4.66E+05	0.00E+00	0.00E+00	0.00E+00	2.11E+04	0.00E+00	2.44E+07	0.00E+00	#DIV/0!	#DIV/0!	2.11E+04	#DIV/0!
I-132	0.00E+00	0.00E+00	4.33E+04	0.00E+00	0.00E+00	0.00E+00	1.27E+05	0.00E+00	2.90E+05	0.00E+00	#DIV/0!	#DIV/0!	1.27E+05	#DIV/0!
I-133	0.00E+00	0.00E+00	1.28E+05	0.00E+00	0.00E+00	0.00E+00	3.36E+04	0.00E+00	5.77E+06	0.00E+00	#DIV/0!	#DIV/0!	3.36E+04	#DIV/0!
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	1.45E+05	0.00E+00	7.60E+04	0.00E+00	#DIV/0!	#DIV/0!	1.45E+05	#DIV/0!
I-135	0.00E+00	0.00E+00	7.10E+04	0.00E+00	0.00E+00	0.00E+00	8.71E+04	0.00E+00	1.19E+06	0.00E+00	#DIV/0!	#DIV/0!	8.71E+04	#DIV/0!
	2.66E+03			2.43E+02				1.14E+06		0.00E+00		#DIV/0!		#DIV/0!

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.14E+08	5.00E+02	#DIV/0!
5.00E+01	5.71E+07	2.50E+02	#DIV/0!
1.00E+03	1.14E+09	5.00E+03	#DIV/0!

X/Q = 2.31E-06 s/m³

Monitor efficiencies from ERS-SFL-85-031 Upstream filtration (iodines reduced 0.01) Release (uCi/s) CF for TEDE = 8.71E+06 (Expression 5)

GW-110 HR SA9 Release Flow Rate = 1.45E+03 cfm : 6.84E+05 cc/s Release (uCi/s) CF for Child Thyroid = 2.28E+06 (Expression 5)

Isotope	U1 SGTR (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.09E+00	7.56E-04	4.69E-01	3.55E-04	6.59E+03	9.62E-03	4.34E-01	4.17E-03
Kr-85m	7.35E+00	2.66E-03	8.17E+02	2.17E+00	2.32E+04	3.38E-02	2.63E+01	8.90E-01
Kr-85	6.74E+02	2.44E-01	1.12E+01	2.73E+00	2.12E+06	3.10E+00	9.67E-01	3.00E+00
Kr-87	4.48E+00	1.62E-03	4.47E+03	7.24E+00	1.41E+04	2.06E-02	1.32E+02	2.73E+00
Kr-88	1.34E+01	4.85E-03	1.13E+04	5.48E+01	4.22E+04	6.17E-02	3.26E+02	2.01E+01
Kr-89	7.66E-02	2.77E-05	1.02E+04	2.83E-01	2.41E+02	3.53E-04	3.06E+02	1.08E-01
Xe-131m	2.76E+01	9.98E-03	4.29E+01	4.28E-01	8.70E+04	1.27E-01	3.35E+00	4.26E-01
Xe-133m	2.34E+01	8.46E-03	1.49E+02	1.26E+00	7.37E+04	1.08E-01	6.92E+00	7.46E-01
Xe-133	1.69E+03	6.11E-01	1.76E+02	1.08E+02	5.33E+06	7.78E+00	3.44E+00	2.67E+01
Xe-135m	2.27E+02	8.21E-02	2.15E+03	1.77E+02	7.15E+05	1.05E+00	7.19E+01	7.51E+01
Xe-135	9.28E+01	3.36E-02	1.25E+03	4.20E+01	2.92E+05	4.27E-01	4.14E+01	1.77E+01
Xe-137	2.33E-01	8.43E-05	9.55E+02	8.05E-02	7.34E+02	1.07E-03	3.13E+01	3.36E-02
Xe-138	1.99E+00	7.20E-04	6.27E+03	4.51E+00	6.27E+03	9.16E-03	1.88E+02	1.72E+00
I-131	1.35E-01	4.88E-05	4.66E+05	2.28E+01	4.25E+02	6.22E-04	3.18E+00	1.98E-03
I-132	4.77E-02	1.73E-05	4.33E+04	7.47E-01	1.50E+02	2.20E-04	1.91E+01	4.20E-03
I-133	1.99E-01	7.20E-05	1.28E+05	9.21E+00	6.27E+02	9.16E-04	5.06E+00	4.64E-03
I-134	2.33E-02	8.43E-06	2.69E+04	2.27E-01	7.34E+01	1.07E-04	2.19E+01	2.35E-03
I-135	1.10E-01	3.98E-05	7.10E+04	2.82E+00	3.47E+02	5.06E-04	1.31E+01	6.65E-03
	2.76E+03			4.35E+02				1.49E+02

Isotope	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	1.73E+03	2.52E-03	4.34E-01	1.09E-03
Kr-85m	0.00E+00	0.00E+00	6.07E+03	8.88E-03	2.63E+01	2.34E-01
Kr-85	0.00E+00	0.00E+00	5.57E+05	8.14E-01	9.67E-01	7.87E-01
Kr-87	0.00E+00	0.00E+00	3.70E+03	5.41E-03	1.32E+02	7.16E-01
Kr-88	0.00E+00	0.00E+00	1.11E+04	1.62E-02	3.26E+02	5.28E+00
Kr-89	0.00E+00	0.00E+00	6.33E+01	9.25E-05	3.06E+02	2.83E-02
Xe-131m	0.00E+00	0.00E+00	2.28E+04	3.33E-02	3.35E+00	1.12E-01
Xe-133m	0.00E+00	0.00E+00	1.93E+04	2.83E-02	6.92E+00	1.96E-01
Xe-133	0.00E+00	0.00E+00	1.40E+06	2.04E+00	3.44E+00	7.01E+00
Xe-135m	0.00E+00	0.00E+00	1.88E+05	2.74E-01	7.19E+01	1.97E+01
Xe-135	0.00E+00	0.00E+00	7.67E+04	1.12E-01	4.14E+01	4.63E+00
Xe-137	0.00E+00	0.00E+00	1.93E+02	2.81E-04	3.13E+01	8.81E-03
Xe-138	0.00E+00	0.00E+00	1.64E+03	2.40E-03	1.88E+02	4.51E-01
I-131	2.44E+07	1.19E+03	1.12E+02	1.63E-04	3.18E+00	5.18E-04
I-132	2.90E+05	5.00E+00	3.94E+01	5.76E-05	1.91E+01	1.10E-03
I-133	5.77E+06	4.15E+02	1.64E+02	2.40E-04	5.06E+00	1.22E-03
I-134	7.60E+04	6.40E-01	1.93E+01	2.81E-05	2.19E+01	6.16E-04
I-135	1.19E+06	4.73E+01	9.09E+01	1.33E-04	1.31E+01	1.75E-03
		1.66E+03		3.34E+00		3.92E+01

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.49E+04	5.00E+02	1.96E+04
5.00E+01	7.46E+03	2.50E+02	9.79E+03
1.00E+03	1.49E+05	5.00E+03	1.96E+05

X/Q = 2.31E-06 s/m³

Monitor efficiencies from ERS-SFL-85-031 Release (uCi/s) CF for TEDE = 1.56E+07 (Expression 5)

GW-110 HR SA9 Release Flow Rate = 1.45E+03 cfm 6.84E+05 cc/s Release (uCi/s) CF for Child Thyroid = #DIV/0! (Expression 5)

Isotope	U1 GW Fail (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.80E+00	1.05E-03	4.69E-01	4.93E-04	1.64E+04	2.40E-02	4.34E-01	1.04E-02
Kr-85m	1.17E+01	4.39E-03	8.17E+02	3.59E+00	6.86E+04	1.00E-01	2.63E+01	2.64E+00
Kr-85	1.16E+03	4.36E-01	1.12E+01	4.88E+00	6.81E+06	9.94E+00	9.67E-01	9.62E+00
Kr-87	5.89E+00	2.21E-03	4.47E+03	9.88E+00	3.46E+04	5.05E-02	1.32E+02	6.68E+00
Kr-88	2.03E+01	7.62E-03	1.13E+04	8.61E+01	1.19E+05	1.74E-01	3.26E+02	5.67E+01
Kr-89	2.12E-01	7.96E-05	1.02E+04	8.12E-01	1.24E+03	1.82E-03	3.06E+02	5.56E-01
Xe-131m	1.77E+01	6.65E-03	4.29E+01	2.85E-01	1.04E+05	1.52E-01	3.35E+00	5.09E-01
Xe-133m	2.45E+01	9.20E-03	1.49E+02	1.37E+00	1.44E+05	2.10E-01	6.92E+00	1.45E+00
Xe-133	1.33E+03	4.99E-01	1.76E+02	8.79E+01	7.80E+06	1.14E+01	3.44E+00	3.92E+01
Xe-135m	3.38E+00	1.27E-03	2.15E+03	2.73E+00	1.98E+04	2.90E-02	7.19E+01	2.08E+00
Xe-135	8.41E+01	3.16E-02	1.25E+03	3.95E+01	4.93E+05	7.21E-01	4.14E+01	2.98E+01
Xe-137	5.59E-01	2.10E-04	9.55E+02	2.00E-01	3.28E+03	4.79E-03	3.13E+01	1.50E-01
Xe-138	2.32E+00	8.71E-04	6.27E+03	5.46E+00	1.36E+04	1.99E-02	1.88E+02	3.73E+00
I-131	0.00E+00	0.00E+00	4.66E+05	0.00E+00	0.00E+00	0.00E+00	3.18E+00	0.00E+00
I-132	0.00E+00	0.00E+00	4.33E+04	0.00E+00	0.00E+00	0.00E+00	1.91E+01	0.00E+00
I-133	0.00E+00	0.00E+00	1.28E+05	0.00E+00	0.00E+00	0.00E+00	5.06E+00	0.00E+00
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	2.19E+01	0.00E+00
I-135	0.00E+00	0.00E+00	7.10E+04	0.00E+00	0.00E+00	0.00E+00	1.31E+01	0.00E+00
	2.66E+03			2.43E+02				1.53E+02

Isotope	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	4.34E-01	#DIV/0!
Kr-85m	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.63E+01	#DIV/0!
Kr-85	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	9.67E-01	#DIV/0!
Kr-87	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.32E+02	#DIV/0!
Kr-88	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.26E+02	#DIV/0!
Kr-89	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.06E+02	#DIV/0!
Xe-131m	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.35E+00	#DIV/0!
Xe-133m	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	6.92E+00	#DIV/0!
Xe-133	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.44E+00	#DIV/0!
Xe-135m	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	7.19E+01	#DIV/0!
Xe-135	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	4.14E+01	#DIV/0!
Xe-137	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.13E+01	#DIV/0!
Xe-138	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.88E+02	#DIV/0!
I-131	2.44E+07	0.00E+00	#DIV/0!	#DIV/0!	3.18E+00	#DIV/0!
I-132	2.90E+05	0.00E+00	#DIV/0!	#DIV/0!	1.91E+01	#DIV/0!
I-133	5.77E+06	0.00E+00	#DIV/0!	#DIV/0!	5.06E+00	#DIV/0!
I-134	7.60E+04	0.00E+00	#DIV/0!	#DIV/0!	2.19E+01	#DIV/0!
I-135	1.19E+06	0.00E+00	#DIV/0!	#DIV/0!	1.31E+01	#DIV/0!
		0.00E+00		#DIV/0!		#DIV/0!

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.53E+04	5.00E+02	#DIV/0!
5.00E+01	7.66E+03	2.50E+02	#DIV/0!
1.00E+03	1.53E+05	5.00E+03	#DIV/0!

Monitor efficiencies from ERS-SFL-85-031 *Upstream filtration (iodines reduced 0.01)*

GW-108B Victoreen Release Flow Rate = 1.45E+03 cfm : 6.84E+05 cc/s

X/Q = 2.31E-06 s/m³
Release (uCi/s) CF for TEDE = 8.71E+06 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.28E+06 (Expression 5)

Isotope	U1 SGTR (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.09E+00	7.56E-04	4.69E-01	3.55E-04	6.59E+03	9.62E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E+03	2.52E-03	0.00E+00	0.00E+00
Kr-85m	7.35E+00	2.66E-03	8.17E+02	2.17E+00	2.32E+04	3.38E-02	9.01E+07	3.05E+06	0.00E+00	0.00E+00	6.07E+03	8.88E-03	9.01E+07	7.99E+05
Kr-85	6.74E+02	2.44E-01	1.12E+01	2.73E+00	2.12E+06	3.10E+00	3.56E+05	1.11E+06	0.00E+00	0.00E+00	5.57E+05	8.14E-01	3.56E+05	2.90E+05
Kr-87	4.48E+00	1.62E-03	4.47E+03	7.24E+00	1.41E+04	2.06E-02	6.78E+07	1.40E+06	0.00E+00	0.00E+00	3.70E+03	5.41E-03	6.78E+07	3.67E+05
Kr-88	1.34E+01	4.85E-03	1.13E+04	5.48E+01	4.22E+04	6.17E-02	1.05E+08	6.46E+06	0.00E+00	0.00E+00	1.11E+04	1.62E-02	1.05E+08	1.69E+06
Kr-89	7.66E-02	2.77E-05	1.02E+04	2.83E-01	2.41E+02	3.53E-04	1.28E+08	4.51E+04	0.00E+00	0.00E+00	6.33E+01	9.25E-05	1.28E+08	1.18E+04
Xe-131m	2.76E+01	9.98E-03	4.29E+01	4.28E-01	8.70E+04	1.27E-01	2.07E+06	2.63E+05	0.00E+00	0.00E+00	2.28E+04	3.33E-02	2.07E+06	6.90E+04
Xe-133m	2.34E+01	8.46E-03	1.49E+02	1.26E+00	7.37E+04	1.08E-01	1.16E+07	1.25E+06	0.00E+00	0.00E+00	1.93E+04	2.83E-02	1.16E+07	3.27E+05
Xe-133	1.69E+03	6.11E-01	1.76E+02	1.08E+02	5.33E+06	7.78E+00	9.24E+06	7.19E+07	0.00E+00	0.00E+00	1.40E+06	2.04E+00	9.24E+06	1.89E+07
Xe-135m	2.27E+02	8.21E-02	2.15E+03	1.77E+02	7.15E+05	1.05E+00	6.58E+07	6.87E+07	0.00E+00	0.00E+00	1.88E+05	2.74E-01	6.58E+07	1.80E+07
Xe-135	9.28E+01	3.36E-02	1.25E+03	4.20E+01	2.92E+05	4.27E-01	1.03E+08	4.40E+07	0.00E+00	0.00E+00	7.67E+04	1.12E-01	1.03E+08	1.16E+07
Xe-137	2.33E-01	8.43E-05	9.55E+02	8.05E-02	7.34E+02	1.07E-03	2.91E+07	3.12E+04	0.00E+00	0.00E+00	1.93E+02	2.81E-04	2.91E+07	8.18E+03
Xe-138	1.99E+00	7.20E-04	6.27E+03	4.51E+00	6.27E+03	9.16E-03	1.06E+08	9.71E+05	0.00E+00	0.00E+00	1.64E+03	2.40E-03	1.06E+08	2.55E+05
I-131	1.35E-01	4.88E-05	4.66E+05	2.28E+01	4.25E+02	6.22E-04	9.34E+07	5.81E+04	2.44E+07	1.19E+03	1.12E+02	1.63E-04	9.34E+07	1.52E+04
I-132	4.77E-02	1.73E-05	4.33E+04	7.47E-01	1.50E+02	2.20E-04	2.18E+08	4.79E+04	2.90E+05	5.00E+00	3.94E+01	5.76E-05	2.18E+08	1.26E+04
I-133	1.99E-01	7.20E-05	1.28E+05	9.21E+00	6.27E+02	9.16E-04	8.26E+07	7.57E+04	5.77E+06	4.15E+02	1.64E+02	2.40E-04	8.26E+07	1.98E+04
I-134	2.33E-02	8.43E-06	2.69E+04	2.27E-01	7.34E+01	1.07E-04	2.17E+08	2.33E+04	7.60E+04	6.40E-01	1.93E+01	2.81E-05	2.17E+08	6.10E+03
I-135	1.10E-01	3.98E-05	7.10E+04	2.82E+00	3.47E+02	5.06E-04	9.33E+07	4.72E+04	1.19E+06	4.73E+01	9.09E+01	1.33E-04	9.33E+07	1.24E+04
	2.76E+03			4.35E+02				1.99E+08		1.66E+03		3.34E+00		5.23E+07

TEDE	cpm	Child Thyroid	cpm
1.00E+02	1.99E+10	5.00E+02	2.62E+10
5.00E+01	9.97E+09	2.50E+02	1.31E+10
1.00E+03	1.99E+11	5.00E+03	2.62E+11

Monitor efficiencies from ERS-SFL-85-031

GW-108B Victoreen Release Flow Rate = 1.45E+03 cfm : 6.84E+05 cc/s

X/Q = 2.31E-06 s/m³
Release (uCi/s) CF for TEDE = 1.56E+07 (Expression 5)
Release (uCi/s) CF for Child Thyroid = #DIV/0! (Expression 5)

Isotope	U1 GW Fail (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.80E+00	1.05E-03	4.69E-01	4.93E-04	1.64E+04	2.40E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	0.00E+00	#DIV/0!
Kr-85m	1.17E+01	4.39E-03	8.17E+02	3.59E+00	6.86E+04	1.00E-01	9.01E+07	9.03E+06	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	9.01E+07	#DIV/0!
Kr-85	1.16E+03	4.36E-01	1.12E+01	4.88E+00	6.81E+06	9.94E+00	3.56E+05	3.54E+06	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.56E+05	#DIV/0!
Kr-87	5.89E+00	2.21E-03	4.47E+03	9.88E+00	3.46E+04	5.05E-02	6.78E+07	3.42E+06	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	6.78E+07	#DIV/0!
Kr-88	2.03E+01	7.62E-03	1.13E+04	8.61E+01	1.19E+05	1.74E-01	1.05E+08	1.82E+07	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.05E+08	#DIV/0!
Kr-89	2.12E-01	7.96E-05	1.02E+04	8.12E-01	1.24E+03	1.82E-03	1.28E+08	2.32E+05	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.28E+08	#DIV/0!
Xe-131m	1.77E+01	6.65E-03	4.29E+01	2.85E-01	1.04E+05	1.52E-01	2.07E+06	3.14E+05	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.07E+06	#DIV/0!
Xe-133m	2.45E+01	9.20E-03	1.49E+02	1.37E+00	1.44E+05	2.10E-01	1.16E+07	2.43E+06	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.16E+07	#DIV/0!
Xe-133	1.33E+03	4.99E-01	1.76E+02	8.79E+01	7.80E+06	1.14E+01	9.24E+06	1.05E+08	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	9.24E+06	#DIV/0!
Xe-135m	3.38E+00	1.27E-03	2.15E+03	2.73E+00	1.98E+04	2.90E-02	6.58E+07	1.91E+06	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	6.58E+07	#DIV/0!
Xe-135	8.41E+01	3.16E-02	1.25E+03	3.95E+01	4.93E+05	7.21E-01	1.03E+08	7.43E+07	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.03E+08	#DIV/0!
Xe-137	5.59E-01	2.10E-04	9.55E+02	2.00E-01	3.28E+03	4.79E-03	2.91E+07	1.39E+05	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.91E+07	#DIV/0!
Xe-138	2.32E+00	8.71E-04	6.27E+03	5.46E+00	1.36E+04	1.99E-02	1.06E+08	2.11E+06	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.06E+08	#DIV/0!
I-131	0.00E+00	0.00E+00	4.66E+05	0.00E+00	0.00E+00	0.00E+00	9.34E+07	0.00E+00	2.44E+07	0.00E+00	#DIV/0!	#DIV/0!	9.34E+07	#DIV/0!
I-132	0.00E+00	0.00E+00	4.33E+04	0.00E+00	0.00E+00	0.00E+00	2.18E+08	0.00E+00	2.90E+05	0.00E+00	#DIV/0!	#DIV/0!	2.18E+08	#DIV/0!
I-133	0.00E+00	0.00E+00	1.28E+05	0.00E+00	0.00E+00	0.00E+00	8.26E+07	0.00E+00	5.77E+06	0.00E+00	#DIV/0!	#DIV/0!	8.26E+07	#DIV/0!
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	2.17E+08	0.00E+00	7.60E+04	0.00E+00	#DIV/0!	#DIV/0!	2.17E+08	#DIV/0!
I-135	0.00E+00	0.00E+00	7.10E+04	0.00E+00	0.00E+00	0.00E+00	9.33E+07	0.00E+00	1.19E+06	0.00E+00	#DIV/0!	#DIV/0!	9.33E+07	#DIV/0!
	2.66E+03			2.43E+02				2.21E+08		0.00E+00		#DIV/0!		#DIV/0!

TEDE	cpm	Child Thyroid	cpm
1.00E+02	2.21E+10	5.00E+02	#DIV/0!
5.00E+01	1.11E+10	2.50E+02	#DIV/0!
1.00E+03	2.21E+11	5.00E+03	#DIV/0!

3. ERS-HHM-87-014, "Unit 1 / Unit 2 ODCM Gaseous Effluent Monitor Setpoints," Revision 4

FORM 1/2-ADM-1611.F28, Rev. 0 RTL# A9.621A

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

Subject Unit 1/ Unit 2 ODCM Gaseous Effluent Monitor Setpoints	REVISION 4 No. **ERS-HHM-87-014**	PAGE 1 OF 29

Reference
HPP: ½-HPP-4.02.002, & 021, **EPP**: N/A, **T/S**: ½-ODC-2.02, **CR**: 00-3928, 03-04830, **ECP**-02-0079

Category
☐ Technical Position ☐ Technical Evaluation ■ Calculation
Unit 1 ■ Unit 2 ■

Purpose
The purpose of this package is to provide Unit 1 and Unit 2 ODCM pre-calculated (default) gaseous effluent monitor alarm setpoints that are traceable to ODCM alarm setpoint methodology. This is applicable for batch and continuous releases of noble gases in gaseous effluents for the following gaseous effluent monitors:

1) For RMS Victoreen Monitors: [RM-1VS-101B, RM-1VS-107B, and RM-1GW-108B]
2) For RMS Eberline SPING Monitors: [RM-1VS-109 Ch 5, RM-1VS-110 Ch 5, & RM-1GW-109 Ch 5]
3) For DRMS GA/Sorrento Monitors: [2HVS-RQ101B, 2HVS-RQ109B, 2RMQ-RQ301B, 2RMQ-RQ301B, and 2HVL-RQ112B]

Rev.	Signatures	Description
4	by *AT Lonnett, 5/13/03* checker/reviewer *RA Moore, 5/21/03* indep review (calculation only) ***N/A, no change in method***	**CR03-04830-05:** Recalculated alarm setpoints for [RM-1GW-108B] and [RM-1GW-109 Ch 5] due to installation of High Capacity Containment Vacuum Pumps for Unit 1 via ECP-02-0079. The new pumps have a maximum capacity of 70 cfm, where as, previous source-term determinations were based on a pump capacity of 5 cfm
3	by *AT Lonnett, 12/07/01* checker/reviewer *RA Moore, 12/07/01* indep review (calculation only) *JT Lebda, 12/7/01*	**CR00-3928-01:** Recalculated alarm setpoints for all gaseous effluent radiation monitors. Specifically, the Lower and Upper Alarm Setpoints were raised, respectively, **from** 10% and 30% of the ODCM Site Dose Rate Limit **to** 30% and 60% of the ODCM Site Dose Rate Limit **Note 1**: Lower = High for Analog Display, or Alert for Digital Display. **Note 2**: Upper = High High for Analog Display, or High for Digital Displays)
2	by *HH Mulcahy, 07/23/87* checker/reviewer *JW Wenkhous, 07/23/87* indep review (calculation only) *WF Wirth for BV-RSC-14-87*	This revision converts the alarm setpoints for the Unit 2 WRGM [2HVS-RQ109] from uCi/cc to uCi/sec. Specifically, the alarm setpoints for this gaseous monitor are not set in the "B" Channel (uCi/cc), like the other Unit 2 gaseous effluent monitors. Rather, the alarm setpoints are set in the "E" Channel (uCi/sec).
1	by *HH Mulcahy, 06/30/87* checker/reviewer *JW Wenkhous, 07/01/87* indep review (calculation only) *N/A, this revision not issued*	**Note:** The RSC determined that this revision to the Calculation Package was not valid. This revision was not issued.
0	by *HH Mulcahy, 05/07/87* checker/reviewer *JW McIntire, 05/26/87* indep review (calculation only) *WF Wirth for RSC, 5/29/87*	Checklist: ■ Purpose ■ Assumptions ■ Methodology ■ Input Data ■ Results ■ References Attachments: ☐ Data Sheets ☐ Illustrations ■ Printouts ☐ Code Listings

■ BV RECORDS CENTER	☐ Supv, Rad Ops-1	■ Author: Anthony T Lonnett
■ HP REH FILE	☐ Supv, Rad Ops-2	■ RMS/DRMS: MS Helms
☐ MGR, Health Physics	☐ Supv, Effl & Rad Waste	☐ ____________
■ Supv, Rad Eng & Health	☐ Training Section	☐ ____________

DISCUSSION

General

All eight gaseous effluent pathways at Unit 1 and Unit 2 are continuously monitored for radioactive materials via the RMS and DRMS. Each of the monitors on these effluent pathways contain at least one channel that is used for monitoring noble gases. The objective of this calculation package is to provide consistent methodology for both units and to provide a bases that is traceable to ODCM setpoint methodology.

Revision 1: The RSC determined that this revision was not valid. This revision was not issued.

Revision 2: This revision converts the alarm setpoints for the Unit 2 WRGM [2HVS-RQ109] from uCi/cc to uCi/sec. Specifically, the alarm setpoints for this gaseous monitor are not set in the "B" Channel (uCi/cc), like the other Unit 2 gaseous effluent monitors. Rather, the alarm setpoints are set in the "E" Channel (uCi/sec).

Revision 3: CR00-3928-01: Recalculated alarm setpoints for all gaseous effluent radiation monitors. Specifically, the Lower and Upper Alarm Setpoints were raised, respectively, **from** 10% and 30% of the ODCM Site Dose Rate Limit **to** 30% and 60% of the ODCM Site Dose Rate Limit. (Reference 13)

Revision 4: CR03-04830-05: Recalculated alarm setpoints for [RM-1GW-108B] and [RM-1GW-109 Ch 5] due to installation of High Capacity Containment Vacuum Pumps for Unit 1 via ECP-02-0079. The new pumps have a maximum capacity of 70 cfm, where as, previous source-term determinations were based on a pump capacity of 5 cfm. (Reference 14)

Original Alarm Setpoint Bases

The original alarm setpoint calculations for Unit 1monitors were implemented in Jan 1984 via Unit 1 Technical Specification Amendment 66 (RETS implementation). The setpoints for Unit 2 monitors were implemented in July 1987 via initial issue of the Unit 2 Technical Specifications. The setpoints are based on the following:

1. The process alarm setpoints were traceable to ODCM procedure ½-ODC-2.02. The upper alarms are set at 30% of the ODCM site dose rate limit for noble gases, and the lower alarms are set at ≤10% of the ODCM site dose rate limit for noble gases.

Unit 1 and 2 Technical Specification Requirements (References 1, 2)

Section 6.8.6.a.1 indicates that the Radioactive Effluent Control Program shall include monitor setpoint determinations that are performed in accordance with the ODCM.

BVPS-1 UFSAR Requirements (Reference 3)

1. Section 11.3.3.3.2 indicates that a high-high activity alarm on RM-1GW-108B will cause automatic closure of valves downstream of the decay tanks, thus terminating the waste gas flow from the decay tank.

2. Section 11.3.3.3.3 does not contain any requirements for alarm setpoints of RM-1VS-101B.

3. Section 11.3.3.3.4 does not contain any requirements for alarm setpoints of RM-1VS-107B.

4. Section 11.3.3.3.23 does not contain any requirements for alarm setpoints of RM-1GW-109 Ch 5, RM-1VS-109 Ch 5, and RM-1VS-110 Ch 5.

BVPS-2 UFSAR Requirements (Reference 4)

1. Section 11.5.2.4.1 does not contain any requirements for alarm setpoints of 2HVS-RQ101B.

2. Section 11.5.2.4.2 does not contain any requirements for alarm setpoints of 2HVS-RQ109B.

3. Section 11.5.2.4.4 does not contain any requirements for alarm setpoints of 2HVL-RQ112B.

4. Section 11.5.2.4.6 indicates that a high alarm on 2RMQ-RQ303B causes flow diversion through filters before being released to the atmosphere.

5. Section 11.5.2.4.7 does not contain any requirements for alarm setpoints of 2RMQ-RQ301B.

BVPS-1 USNRC SER Requirements (Reference 5)

Although Section 11.6 and 11.7 do not contain any requirements for alarm setpoints of the gaseous channels of any Unit 1 gaseous effluent monitors, it does indicate that the process monitoring system is adequate for monitoring effluent discharge paths as described in GDC 64.

BVPS-2 USNRC SER Requirements (Reference 6)

Although Section 11.5 does not contain any requirements for alarm setpoints of the gaseous channels of any Unit 2 gaseous effluent monitors it does indicate that the process monitoring system is adequate for monitoring effluent discharge paths as described in GDC 64.

Other Regulatory Commitments

There are no other known regulatory requirements for the alarm setpoints of the gaseous channels of these gaseous effluent monitors.

Offsite Dose Calculation Manual (ODCM) Requirements (References 7, 8)

Section 8.1 of ODCM procedure ½-ODC-2.02 describes the methodology to be used for alarm setpoint determination. All setpoints are based on a fraction of the limits specified in Control 3.11.2.1 of procedure ½-ODC-3.03 for release of noble gases from the site. The limits are as follows:

≤500 mrem/yr to the Total Body

≤3000 mrem/yr to the Skin

Instrument Error Considerations (References 9, 10, 11)

The original Unit 1 alarm setpoint calculations did not consider the effect of instrument and process errors on the alarm setpoints. Unit 2 alarm setpoints did assess this effect for most monitors, and the Unit 2 UFSAR does contain a commitment to Regulatory Guide 1.105. The Radiation Safety Committee discussed this issue in meeting BV-RSC-25-87. From these discussions, a position with regard to the applicability of RG 1.105 to the radiation monitors was developed and documented in ERS-SFL-87-036. From this position, it is inferred that, as a licensing item, RG 1.105 does not apply to the gaseous channels of the gaseous effluent monitors at Unit 1 and Unit 2.

BASES

The alarm setpoints will be calculated using ODCM procedure ½-ODC-2.02 methodology for gaseous monitor setpoints so that the limits will not be exceeded in the Unrestricted Area.

INPUT DATA/ASSUMPTIONS

	References
Ai = Particulate Activity from the release path (Ci/yr)	[4, 7 & Attachment 4]
x/Q = Dispersion Parameter (sec/m^3)	[7]
F = Discharge Flowrate (cfm)	[7]
Ei = Monitor Sensitivity (cpm/uCi/cc)	[7]
Ki = Total Body Dose Factor (mrem/yr/uCi/m^3)	[7]
Li = Skin Dose Factor (mrem/yr/uCi/m^3)	[7]
Mi = Gamma Air Dose Factor (mrad/yr/uCi/m^3)	[7]
Vi = Total Body Dose Rate Factor (mrem/yr/uCi/m^3)	[7]
Bi = Gamma Air Dose Rate Factor (mrad/yr/uCi/m^3)	[7]

METHODOLOGY

An EXCEL spreadsheet was generated to perform the alarm setpoint calculations (see Attachment 2 for batch release setpoints and see Attachment 3 for continuous release setpoints).

1. Si: Calculated using 1/2-ODC-2.02 equation [(2.1(1)-1] for BV-1, [2.1(2)-1] for BV-2 and [2.1-9] for BV-1/2:):

$$Si = \frac{Ai}{\sum_i Ai}$$

where: Si = the fraction of total radioactivity

Ai = the appropriate individual nuclide source term values from BVPS-2 UFSAR Tables 11.3-1 & 11.3-2, ½-ODC-2.02 Tables 2.1-1a & 2.1-1b, ½-ODC-2.02 Section 8.1, and Attachment 4 (Ci/yr)

2 Q_t: Calculated for whole body exposure using 1/2-ODC-2.02 equation [(2.1(1)-2], [2.1(2)-2], and [2.1-10]:

$$Q_t = \frac{500}{(x/Q) \sum_i KiSi}, \textit{ or } \qquad Q_t = \frac{500}{(x/Q) \sum_i ViSi}$$

where: Q_t the max acceptable total release rate (uCi/sec)

500 = TS/ODCM Total Body Dose Rate Limit due from Noble Gases (mrem/yr)

x/Q = appropriate dispersion parameter from the ODCM procedure ½-ODC-2.02 (sec/m3)

Ki = total whole body dose factors from ODCM procedure ½-ODC-2.02, Table 2.2-11 (mrem/yr/uCi/m3)

Vi = total whole body dose factors from ODCM procedure ½-ODC-2.02, Table 2.2-12 (mrem/yr/uCi/sec)

Si = previously described

3 Q_t: Calculated for skin exposure using 1/2-ODC-2.02 equation [(2.1(1)-3], [2.1(2)-3], and [2.1-11]:

$$Q_t = \frac{3000}{(x/Q)\sum_i (Li + 1.1Ki)Si}, \textit{ or } \qquad Q_t = \frac{3000}{(x/Q)\sum_i [Li(x/Q) + 1.1Bi]Si}$$

where: Q_t = the max acceptable total release rate (uCi/sec)

3000 = TS/ODCM Skin Dose Rate Limit due from Noble Gases (mrem/yr)

x/Q = previously described

Li = skin dose factors from ODCM procedure ½-ODC-2.02, Table 2.2-11 (mrem/yr/uCi/m3)

Mi = gamma air dose factors from ODCM procedure ½-ODC-2.02, Table 2.2-11 (mrad/yr/uCi/sec)

Bi= gamma air dose rate factors from ODCM procedure ½-ODC-2.02, Table 2.2-12 (mrad/yr/uCi/sec)

Si = previously described

4 Qi: Calculated using 1/2-ODC-2.02 equation [(2.1(1)-4], [2.1(2)-4], and [2.1-12]:

Qi = Si Qt

where: Qi = max acceptable release rate for each radionuclide (uCi/sec)

Si = previously described

Qt = previously described

5 Ci: Calculated using 1/2-ODC-2.02 equation [(2.1(1)-5], [2.1(2)-5], and [2.1-13]:

$$Ci = \frac{2.12E-3\ Qi}{F}$$

where: Ci = max acceptable radioactivity concentration for each radionuclide (uCi/cc)

F = the max acceptable effluent flow rate at the point of release for the appropriate pathway (cfm)

2.12E-3 = conversion factor (60 sec/min x 3.53E-5 ft^3/cc)

6 The monitor count rate (CR) was calculated using 1/2-ODC-2.02 equation (2.1-6):

CR = $\sum$ Ci Ei

where: CR = monitor count rate attributed from each radionuclide (ncpm)

Ci = previously described

Ei = detection efficiency for the appropriate monitor form ODCM procedure ½-ODC-2.02, Table 2..1-2a and 2.1-2b.

7. The monitor alarm process setpoints were calculated using 1/2-ODC-2.02 equation [2.1-7] and [2.1-8] as follows:

Unit 1: HHSP = 0.60 CR = 300 mrem/yr <u>and</u> HSP = 0.30 CR = 900 mrem/yr

Unit 2: HSP = 0.60/Eia = 300 mrem/yr <u>and</u> ASP = 0.30/Eia = 900 mrem/yr

<u>where</u>: the process upper alarms (HHSP and HSP) and the process lower alarms (HSP and ASP) are the monitor alarm setpoints above background for the process stream (net cpm or net uCi/cc)

CR = previously described

Eia = for Unit 2 monitors only; this calculation was calculated per 1/2-ODC-2.02 equation [2.1-8] where Eia is calculated as follows:

Eia = CR/(ΣCi for the respective mix)

0.60 and 0.30 = fractions of total radioactivity concentration that may be released via the monitored pathway to ensure that the TS/ODCM Dose Rate Limits are not exceeded.

8. The monitor process setpoints were then compared to <u>Routine Mean Background</u> and <u>Instrument Display Range</u>. The final monitor process setpoints ensure that no gaseous monitor calculated setpoint is close enough to the Routine Monitor Background that would cause an alarm. This did not occur for any of these setpoints. Also, when a calculated setpoint was greater than the Instrument Display Range, on-scale values of 30% and 10% of the upper Instrument Display Range were substituted.

RESULTS

See Attachment 1 for a summary of the gaseous monitor alarm setpoints for batch and continuous releases of gaseous effluents at Unit 1 and Unit 2.

REFERENCES

1. FENOC, Unit 1 Technical Specification 6.8.6a

2. FENOC, Unit 2 Technical Specification 6.8.6a

3. FENOC, Section 5 and Section 11 of Updated Final Safety Analysis Report for Unit 1

4. FENOC, Section 11 of Updated Final Safety Analysis Report for Unit 2

5. USNRC, Safety Evaluation Report Related To The Operation Of The Beaver Valley Power Station Unit 1, (Through Supplement 3)

6. USNRC, Safety Evaluation Report Related To The Operation Of The Beaver Valley Power Station Unit 2, (Through Supplement 6)

7. FENOC, ODCM procedure 1/2-ODC-2.02, Gaseous Effluents

8. FENOC, ODCM procedure 1/2-ODC-3.03, Controls for RETS and REMP Programs

9. USNRC, Instrument Setpoints, Regulatory Guide 1.105; 1976

10. DLC, Minutes Of Radiation Safety Committee Meeting 25-87, BV-RSC-25-87; 1987

11. FENOC, Applicability of RG 1.105 To BVPS Radiation Monitors, ERS-SFL-87-036, Revision 0; 1987

12. SWEC, Gaseous Releases from Containment Vacuum Pumps, UR(B)-262, Revision 0; 1983

13. CR00-3928, RM-1VS-107A Recurring High Alarms, CA-01; Revise Calculation Packages to re-calculate the alarm setpoints for the gaseous effluent pathway radiation monitors. Specifically, the lower and upper alarm setpoints will be raised **from** 10% and 30% of the ODCM Site Dose Rate Limit (for Noble Gas releases) **to** 30% and 60% of the ODCM Site Dose rate Limit (for Noble Gas Releases).

14. CR03-04830, Containment Vacuum Pump Replacement Increases ODCM Source-Term, CA-05; Revise Calculation Package ERS-HHM-87-014 to show adjustment of Containment Vacuum Pump Source. Specifically, the Old Source-Term was developed using a flowrate of 5 cfm, where as, a New Source-Term needs developed using a flowrate of 70 cfm.

ATTACHMENTS

1. **Alarm Setpoint Summary:** Contains the Final Process Alarm Setpoins. This ATTACHMENT is comprised of data from ATTACHMENT 2 and ATTACHMENT 3)

2. **Batch Releases:** Determination Of Gaseous Monitor Alarm Setpoints

3. **Continuous Releases:** De **CR00-3928-01**termination Of Gaseous Monitor Alarm Setpoints

4. **Adjustment of Unit 1 Containment Vacuum Pump Source Term**

Alarm Setpoint Summary

Process Alarm Setpoints For Gaseous Effluent (Noble Gas) Monitors

Unit 1 & 2 Continuous Releases		Raw Process Setpoints	Routine Mean (cpm), or (uCi/cc) Background (cpm), or (uCi/cc)	Instrument Display Ranges		Final Process Setpoints
RM-1VS-101B	HHSP (cpm) =	1.80E+03	75	10		NA; See Raw HHSP
RM-1VS-101B	HSP (cpm) =	9.00E+02	75	1E+06		NA; See Raw HSP
RM-1VS-109 Channel 5	HSP (cpm) =	8.79E+02	0	10		NA; See Raw HSP
RM-1VS-109 Channel 5	ASP (cpm) =	4.40E+02	0	1E+06		NA; See Raw ASP
RM-1VS-107B	HHSP (cpm) =	3.87E+03	99	10		NA; See Raw HHSP
RM-1VS-107B	HSP (cpm) =	1.93E+03	99	1E+06		NA; See Raw HSP
RM-1VS-110 Channel 5	HSP (cpm) =	2.03E+03	0	10		NA; See Raw HSP
RM-1VS-110 Channel 5	ASP (cpm) =	1.01E+03	0	1.2E+06		NA; See Raw ASP
RM-1GW-108B	HHSP (cpm) =	2.09E+07	323	10		3.60E+05
RM-1GW-108B	HSP (cpm) =	1.05E+07	323	1.2E+06		1.20E+05
RM-1GW-109 Channel 5	HSP (cpm) =	1.57E+07	0	10		3.60E+05
RM-1GW-109 Channel 5	ASP (cpm) =	7.84E+06	0	1.2E+06		1.20E+05
2HVS-RQ101B	HSP (uCi/cc) =	1.81E-04	1.92E-06	10	3.65E-07	NA; See Raw HSP
2HVS-RQ101B	ASP (uCi/cc) =	9.04E-05	1.92E-06	1E+07	3.65E-01	NA; See Raw ASP
2HVS-RQ109B	HSP (uCi/sec) =	1.77E+03	NA	NA	NA	NA; See Raw HSP
2HVS-RQ109B	ASP (uCi/sec) =	8.83E+02	NA	NA	NA	NA; See Raw ASP
2RMQ-RQ301B	HSP (uCi/cc) =	1.89E-03	2.20E-06	10	5.56E-07	NA; See Raw HSP
2RMQ-RQ301B	ASP (uCi/cc) =	9.44E-04	2.20E-06	1E+07	5.56E-01	NA; See Raw ASP
2RMQ-RQ303B	HSP (uCi/cc) =	1.55E-02	2.86E-06	10	2.83E-07	NA; See Raw HSP
2RMQ-RQ303B	ASP (uCi/cc) =	7.74E-03	2.86E-06	1E+07	2.83E-01	NA; See Raw ASP
2HVL-RQ112B	HSP (uCi/cc) =	9.63E-04	3.09E-05	10	5.56E-07	NA; See Raw HSP
2HVL-RQ112B	ASP (uCi/cc) =	4.82E-04	3.09E-05	1E+07	5.56E-01	NA; See Raw ASP
Unit 1 Batch Release - Containment Purge						
RM-1VS-101B	HHSP (cpm) =	7.18E+02	75	10		NA; See Raw HHSP
RM-1VS-101B	HSP (cpm) =	3.59E+02	75	1E+06		NA; See Raw HSP
RM-1VS-109 Channel 5	HSP (cpm) =	8.60E+02	0	10		NA; See Raw HSP
RM-1VS-109 Channel 5	ASP (cpm) =	4.30E+02	0	1.2E+06		NA; See Raw ASP
RM-1VS-107B	HHSP (cpm) =	7.63E+03	99	10		NA; See Raw HHSP
RM-1VS-107B	HSP (cpm) =	3.81E+03	99	1E+06		NA; See Raw HSP
RM-1VS-110 Channel 5	HSP (cpm) =	4.00E+03	0	10		NA; See Raw HSP
RM-1VS-110 Channel 5	ASP (cpm) =	2.00E+03	0	1.2E+06		NA; See Raw ASP
Unit 1 & 2 Batch Release - Decay Tank Discharges						
RM-1GW-108B	HHSP (cpm) =	2.36E+05	323	10		NA; See Raw HHSP
RM-1GW-108B	HSP (cpm) =	1.18E+05	323	1E+06		NA; See Raw HSP
RM-1GW-109 Channel 5	HSP (cpm) =	4.72E+06	0	10		3.60E+05
RM-1GW-109 Channel 5	ASP (cpm) =	2.36E+06	0	1.2E+06		1.20E+05
Unit 2 Batch Release - Containment Purge						
2HVS-RQ101B	HSP (uCi/cc) =	4.43E-05	1.92E-06	10	3.65E-07	NA; See Raw HSP
2HVS-RQ101B	ASP (uCi/cc) =	2.22E-05	1.92E-06	1E+07	3.65E-01	NA; See Raw ASP
2HVS-RQ109B	HSP (uCi/sec) =	6.76E+02	NA	NA	NA	NA; See Raw HSP
2HVS-RQ109B	ASP (uCi/sec) =	3.38E+02	NA	NA	NA	NA; See Raw ASP

Unit 1 - Containment Purge VIA Ventilation Vent Pathway Gaseous Effluent Monitor (Victoreen)

RM-1VS-101B

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	2.5E+01	1.41E-01	8.84E+03	1.24E+03	2.69E+03	9.30E+03	1.82E+03	1.48E+02	1.05E-05	7.17E+07	7.51E+02
2 Kr-83m	2.2E-02	1.24E-04	7.56E-02	9.35E-06	0.00E+00	1.93E+01	2.63E-03	1.31E-01	9.22E-09	0.00E+00	0.00E+00
3 Kr-85m	1.5E-01	8.44E-04	1.17E+03	9.87E-01	1.46E+03	1.23E+03	2.37E+00	8.90E-01	6.29E-08	9.80E+07	6.16E+00
4 Kr-85	6.1E+01	3.43E-01	1.61E+01	5.52E+00	1.34E+03	1.72E+01	4.66E+02	3.62E+02	2.56E-05	3.88E+05	9.92E+00
5 Kr-87	5.4E-02	3.04E-04	5.92E+03	1.80E+00	9.73E+03	6.17E+03	5.02E+00	3.20E-01	2.26E-08	7.38E+07	1.67E+00
6 Kr-88	2.4E-01	1.35E-03	1.47E+04	1.98E+01	2.37E+03	1.52E+04	2.58E+01	1.42E+00	1.01E-07	1.14E+08	1.15E+01
7 Kr-89	4.7E-04	2.64E-06	1.66E+04	4.39E-02	1.01E+04	1.73E+04	7.70E-02	2.79E-03	1.97E-10	1.39E+08	2.74E-02
8 Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	1.34E+08	0.00E+00
9 Xe-131m	7.4E-01	4.16E-03	9.15E+01	3.81E-01	4.76E+02	1.56E+02	2.70E+00	4.39E+00	3.10E-07	2.25E+06	6.98E-01
10 Xe-133m	8.9E-01	5.01E-03	2.51E+02	1.26E+00	9.94E+02	3.27E+02	6.78E+00	5.28E+00	3.73E-07	1.26E+07	4.70E+00
11 Xe-133	8.9E+01	5.01E-01	2.94E+02	1.47E+02	3.06E+02	3.53E+02	3.48E+02	5.28E+02	3.73E-05	1.01E+07	3.77E+02
12 Xe-135m	4.5E-03	2.53E-05	3.12E+03	7.90E-02	7.11E+02	3.36E+03	1.12E-01	2.67E-02	1.89E-09	7.15E+07	1.35E-01
13 Xe-135	7.0E-01	3.94E-03	1.81E+03	7.13E+00	1.86E+03	1.92E+03	1.56E+01	4.15E+00	2.93E-07	1.12E+08	3.29E+01
14 Xe-137	1.0E-03	5.62E-06	1.42E+03	7.99E-03	1.22E+04	1.51E+03	7.80E-02	5.93E-03	4.19E-10	3.16E+07	1.32E-02
15 Xe-138	1.5E-02	8.44E-05	8.83E+03	7.45E-01	4.13E+03	9.21E+03	1.20E+00	8.90E-02	6.29E-09	1.15E+08	7.23E-01
Totals -	1.8E+02			1.43E+03			2.69E+03		7.45E-05		1.20E+03

3.32E-04 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)
30000 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 1.05E+03 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 3.36E+03 uCi/sec
Lowest Qt Value = 1.05E+03 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1a
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2a

CR = Sum(CiEi) = 1.20E+03 cpm = CR
HHSP - (CR x 0.6) Where; 0.6 = 60% of the Site Noble Gas Dose Rate Limit = 7.18E+02 cpm = Process HHSP
HSP - (CR x 0.3) Where; 0.3 = 30% of the Site Noble Gas Dose Rate Limit = 3.59E+02 cpm = Process HSP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.1

Trip -- HHSP = 7.18E+02 / (1 + .35 + .10) = 4.95E+02 cpm
Trip --- HSP = 3.59E+02 / (1 + .35 + .10) = 2.48E+02 cpm

Batch Release

Unit 1 Containment Purge VIA Ventilation Vent Pathway Gaseous Effluent Monitor (Eberline - SPING)

RM-1VS-109 Channel 5

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	2.5E+01	1.41E-01	8.84E+03	1.24E+03	2.69E+03	9.30E+03	1.82E+03	1.48E+02	1.05E-05	3.00E+07	3.14E+02
2 Kr-83m	2.2E-02	1.24E-04	7.56E-02	9.35E-06	0.00E+00	1.93E+01	2.63E-03	1.31E-01	9.22E-09	0.00E+00	0.00E+00
3 Kr-85m	1.5E-01	8.44E-04	1.17E+03	9.87E-01	1.46E+03	1.23E+03	2.37E+00	8.90E-01	6.29E-08	2.39E+07	1.50E+00
4 Kr-85	6.1E+01	3.43E-01	1.61E+01	5.52E+00	1.34E+03	1.72E+01	4.66E+02	3.62E+02	2.56E-05	2.47E+07	6.32E+02
5 Kr-87	5.4E-02	3.04E-04	5.92E+03	1.80E+00	9.73E+03	6.17E+03	5.02E+00	3.20E-01	2.26E-08	2.95E+07	6.68E-01
6 Kr-88	2.4E-01	1.35E-03	1.47E+04	1.98E-01	2.37E+03	1.52E+04	2.58E-01	1.42E+00	1.01E-07	2.11E+07	2.12E+00
7 Kr-89	4.7E-04	2.64E-06	1.66E+04	4.39E-02	1.01E+04	1.73E+04	7.70E-02	2.79E-03	1.97E-10	2.93E+07	5.77E-03
8 Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	3.05E+07	0.00E+00
9 Xe-131m	7.4E-01	4.16E-03	9.15E+01	3.81E-01	4.76E+02	1.56E+02	2.70E+00	4.39E+00	3.10E-07	1.56E+07	4.84E+00
10 Xe-133m	8.9E-01	5.01E-03	2.51E+02	1.26E+00	9.94E+02	3.27E+02	6.78E+00	5.28E+00	3.73E-07	1.94E+07	7.24E+00
11 Xe-133	8.9E+01	5.01E-01	2.94E+02	1.47E+02	3.06E+02	3.53E+02	3.48E+02	5.28E+02	3.73E-05	1.24E+07	4.63E+02
12 Xe-135m	4.5E-03	2.53E-05	3.12E+03	7.90E-02	7.11E+02	3.36E+03	1.12E-01	2.67E-02	1.89E-09	5.70E+06	1.08E-02
13 Xe-135	7.0E-01	3.94E-03	1.81E+03	7.13E+00	1.86E+03	1.92E+03	1.56E+01	4.15E+00	2.93E-07	2.91E+07	8.54E+00
14 Xe-137	1.0E-03	5.62E-06	1.42E+03	7.99E-03	1.22E+04	1.51E+03	7.80E-02	5.93E-03	4.19E-10	2.96E+07	1.24E-02
15 Xe-138	1.5E-02	8.44E-05	8.83E+03	7.45E-01	4.13E+03	9.21E+03	1.20E+00	8.90E-02	6.29E-09	2.66E+07	1.67E-01
Totals	1.8E+02			1.43E+03			2.69E+03		7.45E-05		1.43E+03

3.32E-04 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)
30000 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 1.05E+03 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 3.36E+03 uCi/sec
Lowest Qt Value = 1.05E+03 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1a
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2a

CR = Sum(CiEi) = 1.43E+03 cpm = CR
HHSP = (CR x 0.6) Where; 0.6 = 60% of the Site Noble Gas Dose Rate Limit = 8.60E+02 cpm = Process HHSP
HSP = (CR x 0.3) Where; 0.3 = 30% of the Site Noble Gas Dose Rate Limit = 4.30E+02 cpm = Process HSP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.1

Trip -- HHSP = 8.60E+02 / (1 + .35 + .10) = 5.93E+02 cpm
Trip --- HSP = 4.30E+02 (1 + .35 + .10) = 2.97E+02 cpm

Batch Release

Unit 1 - Containment Purge VIA Rx Containment/SLCRS Vent Pathway Gaseous Effluent Monitor (Victoreen)

RM-1VS-107B

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	2.5E+01	1.41E-01	8.84E+03	1.24E+03	2.69E-03	9.30E+03	1.82E+03	1.60E+02	4.52E-05	7.19E+07	3.25E+03
2 Kr-83m	2.2E-02	1.24E-04	7.56E-02	9.35E-06	0.00E+00	1.93E+01	2.63E-03	1.41E-01	3.98E-08	0.00E+00	0.00E+00
3 Kr-85m	1.5E-01	8.44E-04	1.17E+03	9.87E-01	1.46E+03	1.23E+03	2.37E+00	9.59E-01	2.71E-07	5.16E+07	1.40E+01
4 Kr-85	6.1E+01	3.43E-01	1.61E+01	5.52E+00	1.34E+03	1.72E+01	4.66E+02	3.90E+02	1.10E-04	5.04E+07	5.56E+03
5 Kr-87	5.4E-02	3.04E-04	5.92E+03	1.80E+00	9.73E+03	6.17E+03	5.02E+00	3.45E-01	9.76E-08	9.60E+07	9.37E+00
6 Kr-88	2.4E-01	1.35E-03	1.47E+04	1.98E+01	2.37E+03	1.52E+04	2.58E+01	1.53E+00	4.34E-07	5.16E+07	2.24E+01
7 Kr-89	4.7E-04	2.64E-06	1.66E+04	4.39E-02	1.01E+04	1.73E+04	7.70E-02	3.01E-03	8.49E-10	9.59E+07	8.15E-02
8 Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	9.87E+07	0.00E+00
9 Xe-131m	7.4E-01	4.16E-03	9.15E+01	3.81E-01	4.76E+02	1.56E+02	2.70E+00	4.73E+00	1.34E-06	2.94E+07	3.93E+01
10 Xe-133m	8.9E-01	5.01E-03	2.51E+02	1.26E+00	9.94E+02	3.27E+02	6.78E+00	5.69E+00	1.61E-06	4.17E+07	6.71E+01
11 Xe-133	8.9E+01	5.01E-01	2.94E+02	1.47E+02	3.06E+02	3.53E+02	3.48E+02	5.69E+02	1.61E-04	2.28E+07	3.67E+03
12 Xe-135m	4.5E-03	2.53E-05	3.12E+03	7.90E-02	7.11E+02	3.36E+03	1.12E-01	2.88E-02	8.13E-09	1.51E+07	1.23E-01
13 Xe-135	7.0E-01	3.94E-03	1.81E+03	7.13E+00	1.86E+03	1.92E+03	1.56E+01	4.48E+00	1.27E-06	6.42E+07	8.12E+01
14 Xe-137	1.0E-03	5.62E-06	1.42E+03	7.99E-03	1.22E+04	1.51E+03	7.80E-02	6.39E-03	1.81E-09	1.05E+08	1.90E-01
15 Xe-138	1.5E-02	8.44E-05	8.83E+03	7.45E-01	4.13E+03	9.21E+03	1.20E+00	9.59E-02	2.71E-08	7.35E+07	1.99E+00
Totals =	1.8E+02			1.43E+03			2.69E+03		3.21E-04		1.27E+04

3.08E-04 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)
7500 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 1.14E+03 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 3.62E+03 uCi/sec
Lowest Qt Value = 1.14E+03 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1a
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2a

CR = Sum(CiEi) = 1.27E+04 cpm = CR
HHSP = (CR x 0.6) Where: 0.6 = 60% of the Site Noble Gas Dose Rate Limit = 7.63E+03 cpm = Process HHSP
HSP = (CR x 0.3) Where: 0.3 = 30% of the Site Noble Gas Dose Rate Limit = 3.81E+03 cpm = Process HSP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.1

Trip -- HHSP = 7.63E+03 / (1 + .35 + .10) = 5.26E+03 cpm
Trip --- HSP = 3.81E+03 / (1 + .35 + .10) = 2.63E+03 cpm

Batch Release

Unit 1 - Containment Purge VIA Rx Containment/SLCRS Vent Pathway Gaseous Effluent Monitor (Eberline - SPING)

RM-1VS-110 Channel 5

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	2.5E+01	1.41E-01	8.64E+03	1.24E+03	2.69E+03	9.30E+03	1.82E+03	1.60E+02	4.52E-05	3.23E+07	1.46E+03
2 Kr-83m	2.2E-02	1.24E-04	7.56E-02	9.35E-06	0.00E+00	1.93E+01	2.63E-03	1.41E-01	3.98E-08	0.00E+00	0.00E+00
3 Kr 85m	1.5E-01	8.44E-04	1.27E+03	9.87E-01	1.46E+03	1.23E+03	2.37E+00	9.59E 01	2.71E 07	2.57E+07	6.97E+00
4 Kr 85	6.1E+01	3.43E-01	1.61E+01	5.52E+00	1.34E+03	1.72E+01	4.66E+02	3.90E+02	1.10E-04	2.67E+07	2.94E+03
5 Kr-87	5.4E-02	3.04E-04	5.92E+03	1.80E+00	9.73E+03	6.17E+03	5.02E+00	3.45E-01	9.76E-08	3.19E+07	3.11E+00
6 Kr-88	2.4E-01	1.35E-03	1.47E+04	1.98E+01	2.37E+03	1.52E+04	2.58E+01	1.53E+00	4.34E-07	2.28E+07	9.89E+00
7 Kr-89	4.7E-04	2.64E-06	1.66E+04	4.39E-02	1.01E+04	1.73E+04	7.70E-02	3.01E-03	8.49E-10	3.16E+07	2.68E-02
8 Kr 90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	3.29E+07	0.00E+00
9 Xe-131m	7.4E-01	4.16E-03	9.15E+01	3.81E-01	4.76E+02	1.56E+02	2.70E+00	4.73E+00	1.34E-06	1.68E+07	2.25E+01
10 Xe-133m	8.9E-01	5.01E 03	2.51E+02	1.26E+00	9.94E+02	3.27E+02	6.78E+00	5.69E+00	1.61E-06	2.09E+07	3.36E+01
11 Xe-133	8.9E+01	5.01E-01	2.94E+02	1.47E+02	3.06E+02	3.53E+02	3.48E+02	5.69E+02	1.61E-04	1.33E+07	2.14E+03
12 Xe 135m	4.5E-03	2.53E-05	3.12E+03	7.90E-02	7.11E+02	3.36E+03	1.12E-01	2.88E-02	8.13E-09	6.15E+06	5.00E-02
13 Xe-135	7.0E-01	3.94E-03	1.81E+03	7.13E+00	1.86E+03	1.92E+03	1.56E+01	4.48E+00	1.27E-06	3.14E+07	3.97E+01
14 Xe-137	1.0E-03	5.62E-06	1.42E+03	7.99E-03	1.22E+04	1.51E+03	7.80E 02	6.39E-03	1.81E-09	3.19E+07	5.77E-02
15 Xe-138	1.5E-02	8.44E-05	8.83E+03	7.45E-01	4.13E+03	9.21E+03	1.20E+00	9.59E-02	2.71E-08	2.87E+07	7.78E-01
Totals -	1.8E+02			1.43E+03			2.69E+03		3.21E-04		6.66E+03

3.08E-04 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)
7500 cfm = Flowrate (From ODCM procedure 1/2 ODC 2.02, Section 8.1.1)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 1.14E+03 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 3.62E+03 uCi/sec
Lowest Qt Value = 1.14E+03 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1a
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2a

CR = Sum(CiEi) = 6.66E+03 cpm = CR
HHSP = (CR x 0.6) Where; 0.6 = 60% of the Site Noble Gas Dose Rate Limit = 4.00E+03 cpm = Process HHSP
HSP = (CR x 0.3) Where; 0.3 = 30% of the Site Noble Gas Dose Rate Limit = 2.00E+03 cpm = Process HSP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.1

Trip -- HHSP = 4.00E+03 / (1 + .35 + .10) = 2.76E+03 cpm
Trip --- HSP = 2.00E+03 / (1 + .35 + .10) = 1.38E+03 cpm

Batch Release

Unit 1/2 - Decay Tank Discharge VIA Process Vent Pathway Gaseous Effluent Monitor (Victoreen)

RM-1GW-1069

Nuclide	Ai	Si	Vi		Li	Bi		Qi	Ci	Ei	CR
		Ai/Sum Ai		ViSi	(Li(X/Q)+1.1Bi)Si			SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/sec	mrem/yr per uCi/sec	mrem/yr per uCi/m3	mrad/yr per uCi/sec	mrem/yr per uCi/sec	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	0.0E+00	0.00E+00	2.68E-03	0.00E+00	2.69E+03	4.02E-03	0.00E+00	0.00E+00	0.00E+00	6.59E+07	0.00E+00
2 Kr-83m	0.0E+00	0.00E+00	4.56E-08	0.00E+00	0.00E+00	3.96E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 Kr-85m	7.3E-02	2.87E-04	4.70E-04	1.35E-07	1.46E+03	7.06E-04	4.71E-06	6.46E+01	9.44E-05	9.00E+07	8.50E+03
4 Kr-85	2.3E+02	9.04E-01	5.54E-06	5.01E-06	1.34E+03	8.40E-06	1.30E-02	2.04E+05	2.98E-01	3.56E+05	1.06E+05
5 Kr-87	0.0E+00	0.00E+00	1.49E-03	0.00E+00	9.73E+03	2.19E-03	0.00E+00	0.00E+00	0.00E+00	6.78E+07	0.00E+00
6 Kr-88	0.0E+00	0.00E+00	4.09E-03	0.00E+00	2.37E-03	6.16E-03	0.00E+00	0.00E+00	0.00E+00	1.05E+08	0.00E+00
7 Kr-89	0.0E+00	0.00E+00	1.15E-03	0.00E+00	1.01E+04	1.86E-03	0.00E+00	0.00E+00	0.00E+00	1.28E+08	0.00E+00
8 Kr-90	0.0E+00	0.00E+00	0.00E+00	0.00E+00	7.29E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.23E+08	0.00E+00
9 Xe-131m	1.3E+00	5.11E-03	1.67E-04	8.53E-07	4.76E+02	3.09E-04	2.78E-05	1.15E+03	1.68E-03	2.07E+06	3.48E+03
10 Xe-133m	0.0E+00	0.00E+00	1.32E-04	0.00E+00	9.94E+02	2.61E-04	0.00E+00	0.00E+00	0.00E+00	1.16E+07	0.00E+00
11 Xe-133	2.3E+01	9.04E-02	1.54E-04	1.39E-05	3.06E+02	2.76E-04	3.23E-04	2.04E+04	2.98E-02	9.24E+06	2.75E+05
12 Xe-135m	0.0E+00	0.00E+00	6.21E-04	0.00E+00	7.11E+02	9.50E-04	0.00E+00	0.00E+00	0.00E+00	6.58E+07	0.00E+00
13 Xe-135	0.0E+00	0.00E+00	6.96E-04	0.00E+00	1.86E+03	1.05E-03	0.00E+00	0.00E+00	0.00E+00	1.03E+08	0.00E+00
14 Xe-137	0.0E+00	0.00E+00	9.66E-05	0.00E+00	1.22E+04	1.46E-04	0.00E+00	0.00E+00	0.00E+00	2.91E+07	0.00E+00
15 Xe-138	0.0E+00	0.00E+00	2.22E-03	0.00E+00	4.13E+03	3.34E-03	0.00E+00	0.00E+00	0.00E+00	1.06E+08	0.00E+00
Totals =	2.5E+02			1.99E-05			1.33E-02		3.29E-01		3.93E+05

1.07E-05 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 6.1.3)
1450 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 6.1.3)

Qt(Total Body) = 500/sum(ViSi) = 2.51E+07 uCi/sec
Qt(Skin) = 3000/sum(Li(X/Q)+1.1Bi)Si = 2.25E+05 uCi/sec
Lowest Qt Value = 2.25E+05 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1a
Vi & Bi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-12 (3)
Li: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2a

CR = Sum(CiEi) = 3.93E+05 cpm = CR
HHSP = (CR x 0.6) Where; 0.6 = 60% of the Site Noble Gas Dose Rate Limit = 2.36E+05 cpm = Process HHSP
HSP = (CR x 0.3) Where; 0.3 = 30% of the Site Noble Gas Dose Rate Limit = 1.18E+05 cpm = Process HSP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.3

Trip -- HHSP - 2.36E+05 / (1 + .35 + .10) = 1.63E+05 cpm
Trip --- HSP - 1.18E+05 / (1 + .35 + .10) = 8.13E+04 cpm

Unit 1/2 - Decay Tank Discharge VIA Process Vent Pathway Gaseous Effluent Monitor (Victoreen)

RM-1GW-109 Channel 5

Nuclide	Ai	Si	Vi		Li	Bi		Qi	Ci	Ei	CR
		Ai/Sum Ai		ViSi	(Li(X/Q)+1.1Bi)Si			SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/sec	mrem/yr per uCi/sec	mrem/yr per uCi/m3	mrad/yr per uCi/sec	mrem/yr per uCi/sec	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	0.0E+00	0.00E+00	2.69E-03	0.00E+00	2.69E+03	4.02E-03	0.00E+00	0.00E+00	0.00E+00	3.05E+07	0.00E+00
2 Kr-83m	0.0E+00	0.00E+00	4.58E-08	0.00E+00	0.00E+00	1.96E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 Kr-85m	7.3E-02	2.87E-04	4.70E-04	1.35E-07	1.46E+03	7.06E-04	4.71E-06	6.46E+01	9.44E-05	2.43E+07	2.29E+03
4 Kr-85	2.3E+02	9.04E-01	5.54E-06	5.01E-06	1.34E+03	8.40E-06	1.30E-02	2.04E+05	2.98E-01	2.51E+07	7.47E+06
5 Kr-87	0.0E+00	0.00E+00	1.45E-03	0.00E+00	9.73E+03	2.29E-03	0.00E+00	0.00E+00	0.00E+00	3.00E+07	0.00E+00
6 Kr-88	0.0E+00	0.00E+00	4.09E-03	0.00E+00	2.37E+03	6.16E-03	0.00E+00	0.00E+00	0.00E+00	2.14E+07	0.00E+00
7 Kr-89	0.0E+00	0.00E+00	1.25E-03	0.00E+00	1.01E+04	1.88E-03	0.00E+00	0.00E+00	0.00E+00	2.98E+07	0.00E+00
8 Kr-90	0.0E+00	0.00E+00	0.00E+00	0.00E+00	7.29E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.10E+07	0.00E+00
9 Xe-131m	1.3E+00	5.11E-03	1.67E-04	8.53E-07	4.76E+02	3.09E-04	2.78E-05	1.15E+03	1.68E-03	1.59E+07	2.67E+04
10 Xe-133m	0.0E+00	0.00E+00	1.32E-04	0.00E+00	9.94E+02	2.61E-04	0.00E+00	0.00E+00	0.00E+00	1.97E+07	0.00E+00
11 Xe-133	2.3E+01	9.04E-02	1.54E-04	1.39E-05	3.06E+02	2.76E-04	3.23E-04	2.04E+04	2.98E-02	1.26E+07	3.75E+05
12 Xe-135m	0.0E+00	0.00E+00	6.21E-04	0.00E+00	7.11E+02	9.50E-04	0.00E+00	0.00E+00	0.00E+00	5.80E+06	0.00E+00
13 Xe-135	0.0E+00	0.00E+00	6.96E-04	0.00E+00	1.86E+03	1.05E-03	0.00E+00	0.00E+00	0.00E+00	2.96E+07	0.00E+00
14 Xe-137	0.0E+00	0.00E+00	9.66E-05	0.00E+00	1.22E+04	1.46E-04	0.00E+00	0.00E+00	0.00E+00	3.01E+07	0.00E+00
15 Xe-138	0.0E+00	0.00E+00	2.22E-03	0.00E+00	4.13E+03	3.34E-03	0.00E+00	0.00E+00	0.00E+00	2.70E+07	0.00E+00
Totals	2.5E+02			1.99E-05			1.33E-02		3.29E-01		7.87E+06

1.07E-05 sec/m3 = X/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.3)
1450 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.3)

Qt(Total Body) = 500/sum(ViSi) = 2.51E+07 uCi/sec
Qt(Skin) = 3000/sum(Li(X/Q)+1.1Bi)Si = 2.25E+05 uCi/sec
Lowest Qt Value = 2.25E+05 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1a
Vi & Bi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-12 (3)
Li: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-12
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment N, Table 2.1-2a

CR = Sum(CiEi) = 7.87E+06 cpm = CR
HHSP = (CR x 0.6) Where: 0.6 = 60% of the Site Noble Gas Dose Rate Limit = 4.72E+06 cpm = Process HHSP
HSP = (CR x 0.3) Where: 0.3 = 30% of the Site Noble Gas Dose Rate Limit = 2.36E+06 cpm = Process HSP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.3

Trip -- HHSP = 4.72E+06 / (1 + .35 + .10) = 3.26E+06 cpm
Trip --- HSP = 2.36E+06 / (1 + .35 + .10) = 1.63E+06 cpm

Batch Release

Unit 2 · Containment Purge VIA SLCRS Unfiltered Pathway Gaseous Effluent Monitor

2HVS-RQ101B

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	2.5E+01	1.46E-01	8.84E+01	1.29E+03	2.69E-03	9.30E+03	1.88E+03	1.52E+02	1.08E-05	3.79E+07	4.08E+02
2 Kr-83m	4.0E-05	2.33E-07	7.56E-02	1.76E-08	0.00E+00	1.93E+01	4.94E-06	2.43E-04	1.72E-11	0.00E+00	0.00E+00
3 Kr-85m	1.4E-02	8.15E-05	1.17E+03	9.54E-02	1.46E+03	1.23E+03	2.29E-01	8.52E-02	6.02E-09	3.20E+07	1.93E-01
4 Kr-85	6.1E+01	3.55E-01	1.61E+01	5.72E+00	1.34E+03	1.72E+01	4.83E+02	3.71E+02	2.62E-05	3.60E+07	9.44E+02
5 Kr-87	5.3E-06	3.09E-08	5.92E+03	1.83E-04	9.73E+03	6.17E+03	5.10E-04	3.23E-05	2.28E-12	3.73E+07	8.50E-05
6 Kr-88	4.1E-03	2.39E-05	1.47E+04	3.51E-01	2.37E+03	1.52E+04	4.56E-01	2.50E-02	1.76E-09	3.05E+07	5.38E-02
7 Kr-89	0.0E+00	0.00E+00	1.66E+04	0.00E+00	1.01E+04	1.73E+04	0.00E+00	0.00E+00	0.00E+00	3.72E+07	0.00E+00
8 Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	3.86E+07	0.00E+00
9 Xe-131m	7.2E-01	4.19E-03	9.15E+01	3.84E-01	4.76E+02	1.56E+02	2.72E+00	4.38E+00	3.10E-07	2.44E+07	7.56E+00
10 Xe-133m	7.6E-01	4.43E-03	2.51E+02	1.11E+00	9.94E+02	3.27E+02	5.99E+00	4.63E+00	3.27E-07	2.86E+07	9.35E+00
11 Xe-133	8.4E+01	4.89E-01	2.94E+02	1.44E+02	3.06E+02	3.53E+02	3.40E+02	5.11E+02	3.61E-05	1.80E+07	6.50E+02
12 Xe-135m	0.0E+00	0.00E+00	3.12E+03	0.00E+00	7.11E+02	3.36E+03	0.00E+00	0.00E+00	0.00E+00	7.22E+06	0.00E+00
13 Xe-135	2.4E-01	1.40E-03	1.81E+03	2.53E+00	1.86E+03	1.92E+03	5.55E+00	1.46E+00	1.03E-07	3.86E+07	3.98E+00
14 Xe-137	0.0E+00	0.00E+00	1.42E+03	0.00E+00	1.22E+04	1.51E+03	0.00E+00	0.00E+00	0.00E+00	3.78E+07	0.00E+00
15 Xe-138	0.0E+00	0.00E+00	8.83E+03	0.00E+00	4.13E+03	9.21E+03	0.00E+00	0.00E+00	0.00E+00	3.52E+07	0.00E+00
Totals -	1.7E+02			1.44E+03			2.72E+03		7.39E-05		2.02E+03

3.32E-04 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)
30000 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 1.05E+03 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 3.32E+03 uCi/sec
Lowest Qt Value = 1.05E+03 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1b
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-1
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment H, Table 2.1-2b

CR = Sum(CiEi) = 2.02E+03 cpm
Eia = (CR) / (Sum Ci) = 2.74E+07 cpm/uCi/cc
Conversion Factor = 1 / Eia = 3.65E-08 uCi/cc/cpm
DV = CR / Eia = 7.39E-05 uCi/cc
Process HSP = ((CR) x (60%: Site Noble Gas Dose Rate Limit)) / Eia = 4.43E-05 uCi/cc = Process HSP
Process ASP = ((CR) x (30%: Site Noble Gas Dose Rate Limit)) / Eia = 2.22E-05 uCi/cc = Process ASP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.2

Trip -- HSP = 4.43E-05 / (1 + .35 + .10) = 3.06E-05 uCi/cc
Trip -- ASP = 2.22E-05 / (1 + .35 + .10) = 1.53E-05 uCi/cc

Batch Release

Unit 2 - Containment Purge VIA SLCRS Filtered Pathway Gaseous Effluent Monitor

2HVS-RQ109B

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	2.5E+01	1.46E-01	8.84E+03	1.29E+03	2.69E+03	9.30E+03	1.88E+03	1.64E+02	4.64E-05	7.90E+07	3.66E+03
2 Kr-83m	4.0E-05	2.33E-07	7.56E-02	1.76E-08	0.00E+00	1.93E+01	4.94E-06	2.62E-04	7.42E-11	0.00E+00	0.00E+00
3 Kr-85m	1.4E-02	8.15E-05	1.17E+03	9.54E-02	1.46E+03	1.23E+03	2.29E-01	9.18E-02	2.60E-08	5.83E+07	1.51E+00
4 Kr-85	6.1E+01	3.55E-01	1.61E+01	5.72E+00	1.34E+03	1.72E+01	4.83E+02	4.00E+02	1.13E-04	7.19E+07	8.13E+03
5 Kr-87	5.3E-06	3.09E-08	5.92E+03	1.83E-04	9.73E+03	6.17E+03	5.10E-04	3.48E-05	9.83E-12	8.85E+07	8.70E-04
6 Kr-88	4.1E-03	2.39E-05	1.47E+04	3.51E-01	2.37E+03	1.52E+04	4.56E-01	2.69E-02	7.60E-09	6.80E+07	5.17E-01
7 Kr-89	0.0E+00	0.00E+00	1.66E+04	0.00E+00	1.01E+04	1.73E+04	0.00E+00	0.00E+00	0.00E+00	8.73E+07	0.00E+00
8 Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	8.80E+07	0.00E+00
9 Xe-131m	7.2E-01	4.19E-03	9.15E+01	3.84E-01	4.76E+02	1.56E+02	2.72E+00	4.72E+00	1.34E-06	4.61E+04	6.16E-02
10 Xe-133m	7.6E-01	4.43E-03	2.51E+02	1.11E+00	9.94E+02	3.27E+02	5.99E+00	4.99E+00	1.41E-06	6.06E+04	8.54E-02
11 Xe-133	8.4E+01	4.89E-01	2.94E+02	1.44E+02	3.06E+02	3.53E+02	3.40E+02	5.51E+02	1.56E-04	2.94E+07	4.58E+03
12 Xe-135m	0.0E+00	0.00E+00	3.12E+03	0.00E+00	7.11E+02	3.36E+03	0.00E+00	0.00E+00	0.00E+00	1.55E+04	0.00E+00
13 Xe-135	2.4E-01	1.40E-03	1.81E+03	2.53E+00	1.86E+03	1.92E+03	5.55E+00	1.57E+00	4.45E-07	7.48E+07	3.33E+01
14 Xe-137	0.0E+00	0.00E+00	1.42E+03	0.00E+00	1.22E+04	1.51E+03	0.00E+00	0.00E+00	0.00E+00	9.07E+07	0.00E+00
15 Xe-138	0.0E+00	0.00E+00	8.83E+03	0.00E+00	4.13E+03	9.21E+03	0.00E+00	0.00E+00	0.00E+00	7.74E+07	0.00E+00
Totals -	1.7E+02			1.44E+03			2.72E+03		3.18E-04		1.64E+04

3.08E-04 sec/m3 - x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)
7500 cfm - Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 1.13E+03 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 3.58E+03 uCi/sec
Lowest Qt Value = 1.13E+03 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1b
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-1I
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2b

CR = Sum(CiEi) = 1.64E+04 cpm
Eia = (CR) / (Sum Ci) = 5.15E+07 cpm/uCi/cc
Conversion Factor = 1 / Eia = 1.94E-08 uCi/cc/cpm
DV = CR / Eia = 3.18E-04 uCi/cc
Process HSP = ((CR) x (60%: Site Noble Gas Dose Rate Limit)) / Eia = 1.91E-04 uCi/cc = Process HSP 6.76E+02 uCi/sec
Process ASP = ((CR) x (30%: Site Noble Gas Dose Rate Limit)) / Eia = 9.55E-05 uCi/cc = Process ASP 3.38E+02 uCi/sec

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.2

Trip -- HSP = 1.91E-04 / (1 + .35 + .10) = 1.32E-04 uCi/cc = Trip HSP = 4.66E+02 uCi/sec
Trip -- ASP = 9.55E-05 / (1 + .35 + .10) = 6.59E-05 uCi/cc = Trip ASP = 2.33E+02 uCi/sec

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	0.0E+00	0.00E+00	8.84E+03	0.00E+00	2.69E+03	9.30E+03	0.00E+00	0.00E+00	0.00E+00	7.17E+07	0.00E+00
2 Kr-83m	4.2E-01	7.90E-03	7.56E-02	5.97E-04	0.00E+00	1.93E+01	1.68E-01	2.09E+01	7.13E-07	0.00E+00	0.00E+00
3 Kr-85m	1.9E+00	3.57E-02	1.17E+03	4.18E+01	1.46E+03	1.23E+03	1.00E+02	9.43E+01	3.23E-06	9.80E+07	3.16E+02
4 Kr 85	2.5E+00	4.70E-02	1.61E+01	7.57E-01	1.34E+03	1.72E+01	6.39E+01	1.24E+02	4.24E-06	3.88E+05	1.65E+00
5 Kr-87	1.3E+00	2.44E-02	5.92E+03	1.45E+02	9.73E+03	6.17E+03	4.04E+02	6.45E+01	2.21E-06	7.38E+07	1.63E+02
6 Kr-88	3.8E+00	7.14E-02	1.47E+04	1.05E+03	2.37E+03	1.52E+04	1.36E+03	1.89E+02	6.45E-06	1.14E+08	7.35E+02
7 Kr-89	1.2E-01	2.26E-03	1.66E+04	3.75E+01	1.01E+04	1.73E+04	6.57E+01	5.96E+00	2.04E-07	1.39E+08	2.83E+01
8 Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	1.34E+08	0.00E+00
9 Xe-131m	1.3E-01	2.44E-03	9.15E+01	2.24E-01	4.76E+02	1.56E+02	1.58E+00	6.45E+00	2.21E-07	2.25E+06	4.97E-01
10 Xe-133m	8.9E-01	1.67E-02	2.51E+02	4.20E+00	9.94E+02	3.27E+02	2.27E+01	4.42E+01	1.51E-06	1.26E+07	1.90E+01
11 Xe-133	3.6E+01	6.77E-01	2.94E+02	1.99E+02	3.06E+02	3.53E+02	4.70E+02	1.79E+03	6.11E-05	1.01E+07	6.17E+02
12 Xe-135m	3.2E-01	6.02E-03	3.12E+03	1.88E+01	7.11E+02	3.36E+03	2.65E+01	1.59E+01	5.43E-07	7.15E+07	3.88E+01
13 Xe-135	4.5E+00	8.46E-02	1.81E+03	1.53E+02	1.86E+03	1.92E+03	3.36E+02	2.23E+02	7.64E-06	1.12E+08	8.56E+02
14 Xe-137	2.1E-01	3.95E-03	1.42E+03	5.61E+00	1.22E+04	1.51E+03	5.47E+01	1.04E+01	3.56E-07	3.16E+07	1.13E+01
15 Xe-138	1.1E+00	2.07E-02	8.83E+03	1.83E+02	4.13E+03	9.21E+03	2.95E+02	5.46E+01	1.87E-06	1.15E+08	2.15E+02
Totals -	5.3E+01			1.84E+03			3.20E+03		9.03E-05		3.00E+03

1.03E-04 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)
62000 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 2.64E+03 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 9.09E+03 uCi/sec
Lowest Qt Value = 2.64E+03 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1a
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2a

CR = Sum(CiEi) = 3.00E+03 cpm = CR
HHSP = (CR x 0.6) Where; 0.6 = 60% of the Site Noble Gas Dose Rate Limit = 1.80E+03 cpm = Process HHSP
HSP = (CR x 0.3) Where; 0.3 = 30% of the Site Noble Gas Dose Rate Limit = 9.00E+02 cpm = Process HSP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.1

Trip -- HHSP = 1.80E+03 / (1 + .35 + .10) = 1.24E+03 cpm
Trip --- HSP = 9.00E+02 / (1 + .35 + .10) = 6.21E+02 cpm

Continuous Release

Unit 1 - Ventilation Vent Pathway Gaseous Effluent Monitor (Eberline - SPING)

RM-1VS-109 Channel 5

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	0.0E+00	0.00E+00	8.84E+03	0.00E+00	2.69E+03	9.30E+03	0.00E+00	0.00E+00	0.00E+00	3.00E+07	0.00E+00
2 Kr-83m	4.2E-01	7.90E-03	7.56E-02	5.97E-04	0.00E+00	1.93E+01	1.68E-01	2.09E+01	7.13E-07	0.00E+00	0.00E+00
3 Kr-85m	1.9E+00	3.57E-02	1.17E+03	4.18E+01	1.46E+03	1.23E+03	1.00E+02	9.43E+01	3.23E-06	2.39E+07	7.71E+01
4 Kr-85	2.5E+00	4.70E-02	1.61E+01	7.57E-01	1.34E+03	1.72E+01	6.39E+01	1.24E+02	4.24E-06	2.47E+07	1.05E+02
5 Kr-87	1.3E+00	2.44E-02	5.92E+03	1.45E+02	9.73E+03	6.17E+03	4.04E+02	6.45E+01	2.21E-06	2.95E+07	6.51E+01
6 Kr-88	3.8E+00	7.14E-02	1.47E+04	1.05E+03	2.37E+03	1.52E+04	1.36E+03	1.89E+02	6.45E-06	2.11E+07	1.36E+02
7 Kr-89	1.2E-01	2.26E-03	1.66E+04	3.75E+01	1.01E+04	1.73E+04	6.57E+01	5.96E+00	2.04E-07	2.93E+07	5.97E+00
8 Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	3.05E+07	0.00E+00
9 Xe-131m	1.3E-01	2.44E-03	9.15E+01	2.24E-01	4.76E+02	1.56E+02	1.58E+00	6.45E+00	2.21E-07	1.56E+07	3.44E+00
10 Xe-133m	8.9E-01	1.67E-02	2.51E+02	4.20E+00	9.94E+02	3.27E+02	2.27E+01	4.42E+01	1.51E-06	1.94E+07	2.93E+01
11 Xe-133	3.6E+01	6.77E-01	2.94E+02	1.99E+02	3.06E+02	3.53E+02	4.70E+02	1.79E+03	6.11E-05	1.24E+07	7.58E+02
12 Xe-135m	3.2E-01	6.02E-03	3.12E+03	1.88E+01	7.11E+02	3.36E+03	2.65E+01	1.59E+01	5.43E-07	5.70E+06	3.10E+00
13 Xe-135	4.5E+00	8.46E-02	1.81E+03	1.53E+02	1.86E+03	1.92E+03	3.36E+02	2.23E+02	7.64E-06	2.91E+07	2.22E+02
14 Xe-137	2.1E-01	3.95E-03	1.42E+03	5.61E+00	1.22E+04	1.51E+03	5.47E+01	1.04E+01	3.56E-07	2.96E+07	1.06E+01
15 Xe-138	1.1E+00	2.07E-02	8.83E+03	1.83E+02	4.13E+03	9.21E+03	2.95E+02	5.46E+01	1.87E-06	2.66E+07	4.97E+01
Totals =	5.3E+01			1.84E+03			3.20E+03		9.03E-05		1.47E+03

1.03E-04 sec/m3 = X/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)
62000 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)

Qt(Total Body) = 500/(X/Q) sum(KiSi) = 2.64E+03 uCi/sec
Qt(Skin) = 3000/(X/Q) sum(Li+1.1Mi)Si = 9.09E+03 uCi/sec
Lowest Qt Value = 2.64E+03 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1a
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2a

CR = Sum(CiEi) = 1.47E+03 cpm = CR
HHSP = (CR x 0.6) Where; 0.6 = 60% of the Site Noble Gas Dose Rate Limit = 8.79E+02 cpm = Process HHSP
HSP = (CR x 0.3) Where; 0.3 = 30% of the Site Noble Gas Dose Rate Limit = 4.40E+02 cpm = Process HSP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.1

Trip - HHSP = 8.79E+02 / (1 + .35 + .10) = 6.06E+02 cpm
Trip --- HSP = 4.40E+02 / (1 + .35 + .10) = 3.03E+02 cpm

Continuous Release

Unit 1   Rx Containment/SLCRS Vent Pathway Gaseous Effluent Monitor (Victoreen)

RM 1VS-107B

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	2.5E+02	1.41E-01	8.84E-03	1.24E-03	2.69E+03	9.30E+03	1.82E+03	5.33E+02	2.29E-05	7.19E+07	1.65E+03
2 Kr-83m	2.2E-02	1.24E-04	7.56E-02	9.35E-06	0.00E+00	1.93E+01	2.63E-03	4.69E-01	2.02E-08	0.00E+00	0.00E+00
3 Kr-85m	1.5E-01	8.44E-04	1.17E+03	9.87E-01	1.46E+03	1.23E+03	2.37E+00	3.20E+00	1.37E-07	5.16E+07	7.09E+00
4 Kr-85	6.1E+01	3.43E-01	1.61E+01	5.52E+00	1.34E+03	1.72E+01	4.66E+02	1.30E+03	5.59E-05	5.04E+07	2.82E+03
5 Kr-87	5.4E-02	3.04E-04	5.92E+03	1.80E+00	9.73E+03	6.17E+03	5.02E+00	1.15E+00	4.95E-08	9.60E+07	4.75E+00
6 Kr-88	2.4E-01	1.35E-03	1.47E+04	1.98E+01	2.37E+03	1.52E+04	2.58E+01	5.12E+00	2.20E-07	5.16E+07	1.14E+01
7 Kr-89	4.7E-04	2.64E-06	1.66E+04	4.39E-02	1.01E+04	1.73E+04	7.70E-02	1.00E-02	4.31E-10	9.59E+07	4.13E-02
8 Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	9.87E+07	0.00E+00
9 Xe-131m	7.4E-01	4.16E-03	9.15E+01	3.81E-01	4.76E+02	1.56E+02	2.70E+00	1.58E+01	6.78E-07	2.94E+07	1.99E+01
10 Xe-133m	8.9E-01	5.01E-03	2.51E+02	1.26E+00	9.94E+02	3.27E+02	6.78E+00	1.90E+01	8.16E-07	4.17E+07	3.40E+01
11 Xe-133	8.9E+01	5.01E-01	2.94E+02	1.47E+02	3.06E+02	3.53E+02	3.48E+02	1.90E+03	8.16E-05	2.28E+07	1.86E+03
12 Xe-135m	4.5E-03	2.53E-05	3.12E+03	7.90E-02	7.11E+02	3.36E+03	1.12E-01	9.59E-02	4.12E-09	1.51E+07	6.23E-02
13 Xe-135	7.0E-01	3.94E-03	1.81E+03	7.13E+00	1.86E+03	1.92E+03	1.56E+01	1.49E+01	6.42E-07	6.42E+07	4.12E+01
14 Xe-137	1.0E-03	5.62E-06	1.42E+03	7.99E-03	1.22E+04	1.51E+03	7.80E-02	2.13E-02	9.17E-10	1.05E+08	9.62E-02
15 Xe-138	1.5E-02	8.44E-05	8.83E+03	7.45E-01	4.13E+03	9.21E+03	1.20E+00	3.20E-01	1.37E-08	7.35E+07	1.01E+00
Totals =	1.8E+02			1.43E+03			2.69E+03		1.63E-04		6.44E+03

9.24E-05 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)
49300 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 3.79E+03 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 1.21E+04 uCi/sec
Lowest Qt Value = 3.79E+03 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1a
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2a

CR = Sum(CiEi) = 6.44E+03 cpm = CR
HHSP = (CR x 0.6) Where; 0.6 = 60% of the Site Noble Gas Dose Rate Limit = 3.87E+03 cpm = Process HHSP
HSP = (CR x 0.3) Where; 0.3 = 30% of the Site Noble Gas Dose Rate Limit = 1.93E+03 cpm = Process HSP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.1

Trip -- HHSP = 3.87E+03 / (1 + .35 + .10) = 2.67E+03 cpm
Trip --- HSP = 1.93E+03 / (1 + .35 + .10) = 1.33E+03 cpm

Continuous Release

Unit 1 - Rx Containment/SLCRS Vent Pathway Gaseous Effluent Monitor (Eberline - SPING)

RM 1VS-110 Channel 5

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	2.5E+01	1.41E-01	8.84E+03	1.24E+03	2.69E+03	9.30E+03	1.82E+03	5.33E+02	2.29E-05	3.23E+07	7.40E+02
2 Kr-83m	2.2E-02	1.24E-04	7.56E-02	9.35E-06	0.00E+00	1.93E+01	2.63E-03	4.69E-01	2.02E-08	0.00E+00	0.00E+00
3 Kr-85m	1.5E-01	8.44E-04	1.17E+03	9.87E-01	1.46E+03	1.23E+03	2.37E+00	3.20E+00	1.37E-07	2.57E+07	3.53E+00
4 Kr-85	6.1E+01	3.43E-01	1.61E+01	5.52E+00	1.34E+03	1.72E+01	4.66E+02	1.30E+03	5.59E-05	2.67E+07	1.49E+03
5 Kr-87	5.4E-02	3.04E-04	5.92E+03	1.80E+00	9.73E+03	6.17E+03	5.02E+00	1.15E+00	4.95E-08	3.19E+07	1.58E+00
6 Kr-88	2.4E-01	1.35E-03	1.47E+04	1.98E+01	2.37E+03	1.52E+04	2.58E+01	5.12E+00	2.20E-07	2.28E+07	5.02E+00
7 Kr-89	4.7E-04	2.64E-06	1.66E+04	4.39E-02	1.01E+04	1.73E+04	7.70E-02	1.00E-02	4.31E-10	3.16E+07	1.36E-02
8 Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	3.29E+07	0.00E+00
9 Xe-131m	7.4E-01	4.16E-03	9.15E+01	3.81E-01	4.76E+02	1.56E+02	2.70E+00	1.58E+01	6.78E-07	1.68E+07	1.14E+01
10 Xe-133m	8.9E-01	5.01E-03	2.51E+02	1.26E+00	9.94E+02	3.27E+02	6.78E+00	1.90E+01	8.16E-07	2.09E+07	1.70E+01
11 Xe-133	8.9E+01	5.01E-01	2.94E+02	1.47E+02	3.06E+02	3.53E+02	3.48E+02	1.90E+03	8.16E-05	1.33E+07	1.08E+03
12 Xe-135m	4.5E-03	2.53E-05	3.12E+03	7.90E-02	7.11E+02	3.36E+03	1.12E-01	9.59E-02	4.12E-09	6.15E+06	2.54E-02
13 Xe-135	7.0E-01	3.94E-03	1.81E+03	7.13E+00	1.86E+03	1.92E+03	1.56E+01	1.49E+01	6.42E-07	3.14E+07	2.01E+01
14 Xe-137	1.0E-03	5.62E-06	1.42E+03	7.99E-03	1.22E+04	1.51E+03	7.80E-02	2.13E-02	9.17E-10	3.19E+07	2.92E-02
15 Xe-138	1.5E-02	8.44E-05	8.83E+03	7.45E-01	4.13E+03	9.21E+03	1.20E+00	3.20E-01	1.37E-08	2.87E+07	3.95E-01
Totals =	1.8E+02			1.41E+03			2.69E+03		1.63E-04		3.38E+03

9.24E-05 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)
49300 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.1)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 3.79E+03 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 1.21E+04 uCi/sec
Lowest Qt Value = 3.79E+03 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1a
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2 ODC-2.02, Attachment B, Table 2.1-2a

CR = Sum(CiEi) = 3.38E+03 cpm = CR
HHSP = (CR x 0.6) Where; 0.6 = 60% of the Site Noble Gas Dose Rate Limit = 2.03E+03 cpm = Process HHSP
HSP = (CR x 0.3) Where; 0.3 = 30% of the Site Noble Gas Dose Rate Limit = 1.01E+03 cpm = Process HSP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.1

Trip -- HHSP = 2.03E+03 / (1 + .35 + .10) = 1.40E+03 cpm
Trip --- HSP = 1.01E+03 / (1 + .35 + .10) = 6.99E+02 cpm

Continuous Release

Unit 1/2 - Process Vent Pathway Gaseous Effluent Monitor (Victoreen)

RM-1GW-108B

Nuclide	Ai	Si	Vi		Li	Bi		Qi	Ci	Ei	CR
		Ai/Sum Ai		ViSi			(Li(X/Q)+1.1Bi)	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/sec	mrem/yr per uCi/sec	mrem/yr per uCi/m3	mrad/yr per uCi/sec	mrem/yr per uCi/sec	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	0.0E+00	0.00E+00	2.68E-03	0.00E+00	2.69E+03	4.02E-03	0.00E+00	0.00E+00	0.00E+00	6.59E+07	0.00E+00
2 Kr 83m	5.5E-01	5.06E-03	4.58E-08	2.32E-10	0.00E+00	3.96E-05	2.20E-07	5.53E+03	8.09E-03	0.00E+00	0.00E+00
3 Kr-85m	2.5E+00	2.26E-02	4.70E-04	1.07E-05	1.46E+03	7.06E-04	9.46E-05	2.49E+04	3.64E-02	9.00E+07	3.28E+06
4 Kr 85	1.4E+01	1.30E-01	5.54E-06	7.19E-07	1.34E+03	8.40E-06	4.03E-04	1.42E+05	2.07E-01	3.56E+05	7.39E+04
5 Kr-87	1.7E+00	1.53E-02	1.45E-03	2.22E-05	9.73E+03	2.19E-03	3.81E-04	1.67E+04	2.45E-02	6.78E+07	1.66E+06
6 Kr-88	4.9E+00	4.52E-02	4.09E-03	1.85E-04	2.37E+03	6.16E-03	5.54E-04	4.94E+04	7.22E-02	1.05E+08	7.59E+06
7 Kr 89	1.5E-01	1.43E-03	1.25E-03	1.79E-06	1.91E+04	1.88E-03	3.63E-05	1.56E+03	2.28E-03	1.26E+08	2.92E+05
8 Kr-90	0.0E+00	0.00E+00	0.00E+00	0.00E+00	7.29E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.23E+08	0.00E+00
9 Xe 131m	3.6E-01	3.29E-03	1.67E-04	5.50E-07	4.76E+02	2.09E-04	4.74E-06	3.60E+03	5.26E-03	2.07E+06	1.09E+04
10 Xe-133m	1.5E+00	1.34E-02	1.32E-04	1.77E-06	9.94E+02	2.61E-04	3.47E-05	1.47E+04	2.15E-02	1.16E+07	2.49E+05
11 Xe-133	7.5E+01	6.91E-01	1.54E-04	1.06E-04	3.06E+02	2.76E-04	6.98E-04	7.55E+05	1.10E+00	9.24E+06	1.02E+07
12 Xe-135m	4.0E-01	3.71E-03	6.21E-04	2.31E-06	7.11E+02	9.50E-04	9.98E-06	4.06E+03	5.94E-03	6.58E+07	3.91E+05
13 Xe-135	5.9E+00	5.46E-02	6.96E-04	3.80E-05	1.86E+03	1.05E-03	2.97E-04	5.97E+04	8.72E-02	1.03E+08	8.98E+06
14 Xe-137	2.6E-01	2.41E-03	9.66E-05	2.33E-07	1.22E+04	1.46E-04	6.83E-05	2.64E+03	3.85E-03	2.91E+07	1.12E+05
15 Xe-138	1.3E+00	1.23E-02	2.22E-03	2.72E-05	4.13E+03	3.34E-03	1.62E-04	1.34E+04	1.96E-02	1.06E+08	2.08E+06
Totals =	1.1E+02			3.97E-04			2.74E-03		1.60E+00		3.49E+07

2.31E-06 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.3)
1450 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.3)

Qt(Total Body) = 500/sum(ViSi) = 1.26E+06 uCi/sec
Qt(Skin) = 3000/sum(Li(X/Q)+1.1Bi)Si = 1.09E+06 uCi/sec
Lowest Qt Value = 1.09E+06 uCi/sec

Ai: Derived from ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1a, as follows:
Ai = (2 x Main Cond Air Ejector) + (U2 RBC Vac Pump) + (14 x Old U1 RBC Vac Pump)
Note: The values for the New U1 RBC Vac Pump (ie; 14 x Old U1 RBC Vac Pump) are documented in Attachment 4

Vi & Bi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-12 (3)
Li: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2a

CR = Sum(CiEi) = 3.49E+07 cpm = CR
HHSP = (CR x 0.6) Where; 0.6 = 60% of the Site Noble Gas Dose Rate Limit = 2.09E+07 cpm = Process HHSP
HSP = (CR x 0.3) Where; 0.3 = 30% of the Site Noble Gas Dose Rate Limit = 1.05E+07 cpm = Process HSP

NOTE: All equations used above are from ODCM procedure 1/2-ODC 2.02, Section 8.1.3

Trip --- HHSP = 2.09E+07 / (1 + .35 + .10) = 1.44E+07 cpm
Trip --- HSP = 1.05E+07 / (1 + .35 + .10) = 7.22E+06 cpm

Continuous Release

Unit 1/2 - Process Vent Pathway Gaseous Effluent Monitor (Eberline - SPING)

RM-1GW-109 Channel 5

Nuclide	Ai	Si	Vi		Li	Bi		Qi	Ci	Ei	CR
		Ai/Sum Ai		ViSi			(Li(X/Q)+1.1Bi)	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/sec	mrem/yr per uCi/sec	mrem/yr per uCi/m3	mrad/yr per uCi/sec	mrem/yr per uCi/sec	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	0.0E+00	0.00E+00	2.68E-03	0.00E+00	2.69E+03	4.02E-03	0.00E+00	0.00E+00	0.00E+00	3.05E+07	0.00E+00
2 Kr-83m	5.5E-01	5.06E-03	4.58E-08	2.32E-10	[illegible]	3.96E-05	2.20E-07	5.53E+03	8.09E-03	0.00E+00	0.00E+00
3 Kr-85m	2.5E+00	2.28E-02	4.70E-04	1.07E-05	1.46E+03	7.06E-04	9.46E-06	2.49E+04	3.64E-02	2.43E+07	8.85E+05
4 Kr-85	1.4E+01	1.30E-01	5.54E-06	7.19E-07	1.34E+03	8.40E-06	4.03E-04	1.42E+05	2.07E-01	2.51E+07	5.21E+06
5 Kr-87	1.7E+00	1.53E-02	1.45E-03	2.22E-05	9.73E+03	2.19E-03	3.81E-04	1.67E+04	2.45E-02	3.00E+07	7.34E+05
6 Kr-88	4.9E+00	4.52E-02	4.09E-03	1.85E-04	2.37E+03	6.16E-03	5.54E-04	4.94E+04	7.22E-02	2.14E+07	1.55E+06
7 Kr-89	1.5E-01	1.43E-03	1.25E-03	1.79E-06	1.01E+04	1.88E-03	3.63E-05	1.56E+03	2.28E-03	2.98E+07	6.80E+04
8 Kr-90	0.0E+00	0.00E+00	0.00E+00	0.00E+00	7.29E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.10E+07	0.00E+00
9 Xe-131m	3.6E-01	3.29E-03	1.67E-04	5.50E-07	4.76E+02	3.09E-04	4.74E-06	3.60E+03	5.26E-03	1.59E+07	8.37E+04
10 Xe-133m	1.5E+00	1.34E-02	1.32E-04	1.77E-06	9.94E+02	2.61E-04	3.47E-05	1.47E+04	2.15E-02	1.97E+07	4.23E+05
11 Xe-133	7.5E+01	6.91E-01	1.54E-04	1.06E-04	3.06E+02	2.76E-04	6.98E-04	7.55E+05	1.10E+00	1.26E+07	1.39E+07
12 Xe-135m	4.0E-01	3.71E-03	6.21E-04	2.31E-06	7.11E+02	9.50E-04	9.98E-06	4.06E+03	5.94E-03	5.80E+06	3.44E+04
13 Xe-135	5.9E+00	5.46E-02	6.96E-04	3.80E-05	1.86E+03	1.05E-03	2.97E-04	5.97E+04	8.72E-02	2.96E+07	2.58E+06
14 Xe-137	2.6E-01	2.41E-03	9.66E-05	2.33E-07	1.22E+04	1.46E-04	6.83E-05	2.64E+03	3.85E-03	3.01E+07	1.16E+05
15 Xe-138	1.3E+00	1.23E-02	2.22E-03	2.72E-05	4.13E+03	3.34E-03	1.62E-04	1.34E+04	1.96E-02	2.70E+07	5.29E+05
Totals	1.1E+02			3.97E-04			2.74E-03		1.60E+00		2.61E+07

2.31E-06 sec/m3 - x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.3)
1450 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.3)

Qt(Total Body) = 500/sum(ViSi) = 1.26E+06 uCi/sec
Qt(Skin) = 3000/sum(Li(X/Q)+1.1Bi)Si = 1.09E+06 uCi/sec
Lowest Qt Value = 1.09E+06 uCi/sec

Ai: Derived from ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1 1a, as follows:
Ai - (2 x Main Cond Air Ejector) + (U2 RBC Vac Pump) + (14 x Old U1 RBC Vac Pump)
Note: The values for the New U1 RBC Vac Pump (i.e; 14 x Old U1 RBC Vac Pump) are documented in Attachment 4

Vi & Bi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-12 (3)
Li: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.1-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2a

CR = Sum(CiEi) = 2.61E+07 cpm = CR
HHSP = (CR x 0.6) Where; 0.6 = 60% of the Site Noble Gas Dose Rate Limit = 1.57E+07 cpm = Process HHSP
HSP = (CR x 0.3) Where; 0.3 = 30% of the Site Noble Gas Dose Rate Limit = 7.84E+06 cpm = Process HSP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.3

Trip - HHSP = 1.57E+07 / (1 + .35 + .10) = 1.08E+07 cpm
Trip - HSP = 7.84E+06 / (1 + .35 + .10) = 5.40E+06 cpm

Unit 2 SLCRS Unfiltered Pathway Gaseous Effluent Monitor

2HVS-RG101B

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	2.5E+01	1.46E-03	8.84E+03	1.29E+03	2.69E+03	9.30E+03	1.88E+03	4.90E+02	4.39E-05	3.79E+07	1.66E+03
2 Kr-83m	4.0E-05	2.33E-07	7.56E-02	1.76E-08	0.00E+00	1.93E+01	4.94E-06	7.85E-04	7.02E-11	0.00E+00	0.00E+00
3 Kr-85m	1.4E-02	8.15E-05	1.17E+03	9.54E-02	1.46E+03	1.23E+03	2.29E-01	2.75E-01	2.46E-08	3.20E+07	7.86E-01
4 Kr-85	6.1E+01	3.55E-01	1.61E+01	5.72E+00	1.34E+03	1.72E+01	4.83E+02	1.20E+03	1.07E-04	3.60E+07	3.85E+03
5 Kr-87	5.3E-06	3.09E-08	5.92E+03	1.83E-04	9.73E+03	6.17E+03	5.10E-04	1.04E-04	9.30E-12	3.73E+07	3.47E-04
6 Kr-88	4.1E-03	2.39E-05	1.47E+04	3.51E-01	2.37E+03	1.52E+04	4.56E-01	8.04E-02	7.19E-09	3.05E+07	2.19E-01
7 Kr-89	0.0E+00	0.00E+00	1.66E+04	0.00E+00	1.01E+04	1.73E+04	0.00E+00	0.00E+00	0.00E+00	3.72E+07	0.00E+00
8 Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	3.86E+07	0.00E+00
9 Xe-131m	7.2E-01	4.19E-03	9.15E+01	3.84E-01	4.76E+02	1.56E+02	2.72E+00	1.41E+01	1.26E-06	2.44E+07	3.08E+01
10 Xe-133m	7.6E-01	4.43E-03	2.51E+02	1.11E+00	9.94E+02	3.27E+02	5.99E+00	1.49E+01	1.33E-06	2.86E+07	3.81E+01
11 Xe-133	8.4E+01	4.89E-01	2.94E+02	1.44E+02	3.06E+02	3.53E+02	3.40E+02	1.65E+03	1.47E-04	1.80E+07	2.65E+03
12 Xe-135m	0.0E+00	0.00E+00	3.12E+03	0.00E+00	7.11E+02	3.36E+03	0.00E+00	0.00E+00	0.00E+00	7.22E+06	0.00E+00
13 Xe-135	2.4E-01	1.40E-03	1.81E+03	2.53E+00	1.86E+03	1.92E+03	5.55E+00	4.71E+00	4.21E-07	3.86E+07	1.63E+01
14 Xe-137	0.0E+00	0.00E+00	1.42E+03	0.00E+00	1.22E+04	1.51E+03	0.00E+00	0.00E+00	0.00E+00	3.78E+07	0.00E+00
15 Xe-138	0.0E+00	0.00E+00	8.83E+03	0.00E+00	4.13E+03	9.21E+03	0.00E+00	0.00E+00	0.00E+00	3.52E+07	0.00E+00
Totals =	1.7E+02			1.44E+03			2.72E+03		3.01E-04		8.26E+03

1.03E-04 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)
23700 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 3.37E+03 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 1.07E+04 uCi/sec
Lowest Qt Value = 3.37E+03 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1b
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2b

CR = Sum(CiEi) =	8.26E+03	cpm
Eia = (CR) / (Sum Ci) =	2.74E+07	cpm/uCi/cc
Conversion Factor = 1 / Eia =	3.65E-08	uCi/cc/cpm
DV = CR / Eia =	3.01E-04	uCi/cc
Process HSP = ((CR) x (60%: Site Noble Gas Dose Rate Limit)) / Eia =	1.81E-04	uCi/cc = Process HSP
Process ASP = ((CR) x (30%: Site Noble Gas Dose Rate Limit)) / Eia =	9.04E-05	uCi/cc = Process ASP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.2

Trip -- HSP = 1.81E-04 / (1 + .35 + .10) = 1.25E-04 uCi/cc
Trip -- ASP = 9.04E-05 / (1 + .35 + .10) = 6.24E-05 uCi/cc

Continuous Release

Unit 2 - SLCRS Filtered Pathway Gaseous Effluent Monitor

2HVS RQ109B

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	0.0E+00	0.00E+00	8.84E+03	0.00E+00	2.69E+03	9.30E+03	0.00E+00	0.00E+00	0.00E+00	7.90E+07	0.00E+00
2 Kr-83m	4.2E-01	7.90E-03	7.56E-02	5.97E-04	0.00E+00	1.93E+01	1.68E-01	2.32E+01	8.35E-07	0.00E+00	0.00E+00
3 Kr 85m	1.9E+00	3.57E-02	1.17E+03	4.18E+01	1.46E+03	1.23E+03	1.00E+02	1.05E+02	3.78E-06	5.83E+07	2.20E+02
4 Kr 85	2.5E+00	4.70E-02	1.61E+01	7.57E-01	1.34E+03	1.72E+01	6.39E+01	1.38E+02	4.97E-06	7.19E+07	3.57E+02
5 Kr 87	1.3E+00	2.44E-02	5.92E+03	1.45E+02	9.73E+03	6.17E+03	4.94E+02	7.19E+01	2.58E-06	8.85E+07	2.29E+02
6 Kr-88	3.8E+00	7.14E-02	1.47E+04	1.05E+03	2.37E+03	1.52E+04	1.36E+03	2.10E+02	7.56E-06	6.80E+07	5.14E+02
7 Kr 89	1.2E-01	2.26E-03	1.66E+04	3.75E+01	1.01E+04	1.73E+04	6.57E+01	6.64E+00	2.39E-07	8.73E+07	2.08E+01
8 Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	8.80E+07	0.00E+00
9 Xe-131m	1.3E-01	2.44E-03	9.15E+01	2.24E-01	4.76E+02	1.56E+02	1.58E+00	7.19E+00	2.58E-07	4.61E+04	1.19E-02
10 Xe 133m	8.9E-01	1.67E-02	2.51E+02	4.20E+00	9.94E+02	3.27E+02	2.27E+01	4.93E+01	1.77E-06	6.06E+04	1.07E-01
11 Xe 133	3.6E+01	6.77E-01	2.94E+02	1.99E+02	3.06E+02	3.53E+02	4.70E+02	1.99E+03	7.10E-05	2.94E+07	2.10E+03
12 Xe-135m	3.2E-01	6.02E-03	3.12E+03	1.88E+01	7.11E+02	3.36E+03	2.65E+01	1.77E+01	6.36E-07	1.55E+04	9.86E-03
13 Xe 135	4.5E+00	8.46E-02	1.81E+03	1.53E+02	1.86E+03	1.92E+03	3.36E+02	2.49E+02	8.95E-06	7.48E+07	6.69E+02
14 Xe-137	2.1E-01	3.95E-03	1.42E+03	5.61E+00	1.22E+04	1.51E+03	5.47E+01	1.16E+01	4.18E-07	9.07E+07	3.79E+01
15 Xe 138	1.1E+00	2.07E-02	8.83E+03	1.83E+02	4.13E+03	9.21E+03	2.95E+02	6.09E+01	2.19E-06	7.74E+07	1.69E+02
Totals =	5.3E+01			1.84E+03			3.20E+03		1.06E-04		4.32E+03

9.24E-05 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)
59000 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 2.94E+03 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 1.01E+04 uCi/sec
Lowest Qt Value = 2.94E+03 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1b
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2b

CR = Sum(CiEi) = 4.32E+03 cpm
Eia = (CR) / (Sum Ci) = 4.09E+07 cpm/uCi/cc
Conversion Factor = 1 / Eia = 2.45E-08 uCi/cc/cpm
DV = CR / Eia = 1.06E-04 uCi/cc
Process HSP = ((CR) x (60%: Site Noble Gas Dose Rate Limit)) / Eia = 6.35E-05 uCi/cc = Process HSP 1.77E+03 uCi/sec
Process ASP = ((CR) x (30%: Site Noble Gas Dose Rate Limit)) / Eia = 3.17E-05 uCi/cc = Process ASP 8.83E+02 uCi/sec

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.2

Trip -- HSP = 6.35E-05 / (1 + .35 + .10) = 4.38E-05 uCi/cc = Trip HSP = 1.22E+03 uCi/sec
Trip -- ASP = 3.17E-05 / (1 + .35 + .10) = 2.19E-05 uCi/cc = Trip ASP = 6.09E+02 uCi/sec

Continuous Release

Unit 2 - Decontamination Building Vent Pathway Gaseous Effluent Monitor

2RMQ-RQ301B

Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
		Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
	Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1 Ar-41	0.0E+00	0.00E+00	8.84E+03	0.00E+00	2.69E+03	9.30E+03	0.00E+00	0.00E+00	0.00E+00	3.79E+07	0.00E+00
2 Kr-83m	0.0E+00	0.00E+00	7.56E-02	0.00E+00	0.00E+00	1.93E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 Kr-85m	0.0E+00	0.00E+00	1.17E+03	0.00E+00	1.46E+03	1.23E+03	0.00E+00	0.00E+00	0.00E+00	3.20E+07	0.00E+00
4 Kr-85	0.0E+00	0.00E+00	1.61E+01	0.00E+00	1.34E+03	1.72E+01	0.00E+00	0.00E+00	0.00E+00	3.60E+07	0.00E+00
5 Kr-87	0.0E+00	0.00E+00	5.92E+03	0.00E+00	9.73E+03	6.17E+03	0.00E+00	0.00E+00	0.00E+00	3.73E+07	0.00E+00
6 Kr-88	0.0E+00	0.00E+00	1.47E+04	0.00E+00	2.37E+03	1.52E+04	0.00E+00	0.00E+00	0.00E+00	3.05E+07	0.00E+00
7 Kr-89	0.0E+00	0.00E+00	1.66E+04	0.00E+00	1.01E+04	1.73E+04	0.00E+00	0.00E+00	0.00E+00	3.72E+07	0.00E+00
8 Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	3.86E+07	0.00E+00
9 Xe-131m	0.0E+00	0.00E+00	9.15E+01	0.00E+00	4.76E+02	1.56E+02	0.00E+00	0.00E+00	0.00E+00	2.44E+07	0.00E+00
10 Xe-133m	0.0E+00	0.00E+00	2.51E+02	0.00E+00	9.94E+02	3.27E+02	0.00E+00	0.00E+00	0.00E+00	2.86E+07	0.00E+00
11 Xe-133	1.0E+00	1.00E+00	2.94E+02	2.94E+02	3.06E+02	3.53E+02	6.94E+02	1.84E+04	3.15E-03	1.80E+07	5.66E+04
12 Xe-135m	0.0E+00	0.00E+00	3.12E+03	0.00E+00	7.11E+02	3.36E+03	0.00E+00	0.00E+00	0.00E+00	7.22E+06	0.00E+00
13 Xe-135	0.0E+00	0.00E+00	1.81E+03	0.00E+00	1.86E+03	1.92E+03	0.00E+00	0.00E+00	0.00E+00	3.86E+07	0.00E+00
14 Xe-137	0.0E+00	0.00E+00	1.42E+03	0.00E+00	1.22E+04	1.51E+03	0.00E+00	0.00E+00	0.00E+00	3.78E+07	0.00E+00
15 Xe-138	0.0E+00	0.00E+00	8.83E+03	0.00E+00	4.13E+03	9.21E+03	0.00E+00	0.00E+00	0.00E+00	3.52E+07	0.00E+00
Totals -	1.0E+00			2.94E+02			6.94E+02		3.15E-03		5.66E+04

9.24E-05 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)
12400 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 1.84E+04 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 4.68E+04 uCi/sec
Lowest Qt Value = 1.84E+04 uCi/sec

Ai: Assume 100% Xe-133 (ie; No Source Term in ODCM procedure 1/2-ODC 2.02, Attachment A, Table 2.1-1b
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2b

CR = Sum(CiEi) = 5.66E+04 cpm
Eia = (CR) / (Sum Ci) = 1.80E+07 cpm/uCi/cc
Conversion Factor = 1 / Eia = 5.56E-08 uCi/cc/cpm
DV = CR / Eia = 3.15E-03 uCi/cc
Process HSP = ((CR) x (60%: Site Noble Gas Dose Rate Limit)) / Eia = 1.89E-03 uCi/cc = Process HSP
Process ASP = ((CR) x (30%: Site Noble Gas Dose Rate Limit)) / Eia = 9.44E-04 uCi/cc = Process ASP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.2

Trip -- HSP = 1.89E-03 / (1 + .35 + .10) = 1.30E-03 uCi/cc
Trip -- ASP = 9.44E-04 / (1 + .35 + .10) = 6.51E-04 uCi/cc

Continuous Release

Unit 2 - Waste Gas Storage Vault Vent Pathway Gaseous Effluent Monitor

2RMO-RQ303B

	Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
			Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
		Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1	Ar-41	0.0E+00	0.00E+00	8.84E+03	0.00E+00	2.69E+03	9.30E+03	0.00E+00	0.00E+00	0.00E+00	3.79E+07	0.00E+00
2	Kr-83m	0.0E+00	0.00E+00	7.56E-02	0.00E+00	0.00E+00	1.93E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3	Kr-85m	1.2E-02	5.02E-05	1.17E+03	5.87E-02	1.46E+03	1.23E+03	1.41E-01	1.22E+00	1.30E-06	3.20E+07	4.15E+01
4	Kr-85	2.3E+02	9.62E-01	1.61E+01	1.55E+01	1.34E+03	1.72E+01	1.31E+03	2.34E+04	2.48E-02	3.60E+07	8.94E+05
5	Kr-87	0.0E+00	0.00E+00	5.92E+03	0.00E+00	9.73E+03	6.17E+03	0.00E+00	0.00E+00	0.00E+00	3.73E+07	0.00E+00
6	Kr-88	0.0E+00	0.00E+00	1.47E+04	0.00E+00	2.37E+03	1.52E+04	0.00E+00	0.00E+00	0.00E+00	3.05E+07	0.00E+00
7	Kr-89	0.0E+00	0.00E+00	1.66E+04	0.00E+00	1.01E+04	1.73E+04	0.00E+00	0.00E+00	0.00E+00	3.72E+07	0.00E+00
8	Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	3.86E+07	0.00E+00
9	Xe-131m	8.3E-01	3.47E-03	9.15E+01	3.18E-01	4.76E+02	1.56E+02	2.25E+00	8.45E+01	8.96E-05	2.44E+07	2.19E+03
10	Xe-133m	0.0E+00	0.00E+00	2.51E+02	0.00E+00	9.94E+02	3.27E+02	0.00E+00	0.00E+00	0.00E+00	2.86E+07	0.00E+00
11	Xe-133	8.2E+00	3.43E-02	2.94E+02	1.01E+01	3.06E+02	3.53E+02	2.38E+01	8.35E+02	8.85E-04	1.80E+07	1.59E+04
12	Xe-135m	0.0E+00	0.00E+00	3.12E+03	0.00E+00	7.11E+02	3.36E+03	0.00E+00	0.00E+00	0.00E+00	7.22E+06	0.00E+00
13	Xe-135	0.0E+00	0.00E+00	1.81E+03	0.00E+00	1.86E+03	1.92E+03	0.00E+00	0.00E+00	0.00E+00	3.86E+07	0.00E+00
14	Xe-137	0.0E+00	0.00E+00	1.42E+03	0.00E+00	1.22E+04	1.51E+03	0.00E+00	0.00E+00	0.00E+00	3.78E+07	0.00E+00
15	Xe-138	0.0E+00	0.00E+00	8.83E+03	0.00E+00	4.13E+03	9.21E+03	0.00E+00	0.00E+00	0.00E+00	3.52E+07	0.00E+00
	Totals	2.4E+02			2.60E+01			1.33E+03		2.58E-02		9.12E+05

9.24E-05 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)
2000 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 2.09E+05 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 2.43E+04 uCi/sec
Lowest Qt Value = 2.43E+04 uCi/sec

Ai: From ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1b (ie; GWS short term)
Ki,Li & Mi: From ODCM procedure 1/2 ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2b

CR = Sum(CiEi) = 9.12E+05 cpm
Eia = (CR) / (Sum Ci) = 3.53E+07 cpm/uCi/cc
Conversion Factor = 1 / Eia = 2.83E-08 uCi/cc/cpm
DV = CR / Eia = 2.58E-02 uCi/cc
Process HSP = ((CR) x (60%: Site Noble Gas Dose Rate Limit)) / Eia = 1.55E-02 uCi/cc = Process HSP
Process ASP = ((CR) x (30%: Site Noble Gas Dose Rate Limit)) / Eia = 7.74E-03 uCi/cc = Process ASP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.2

Trip -- HSP = 1.55E-02 / (1 + .35 + .10) = 1.07E-02 uCi/cc
Trip -- ASP = 7.74E-03 / (1 + .35 + .10) = 5.34E-03 uCi/cc

Unit 2 - Condensate Polishing Building Vent Pathway Gaseous Effluent Monitor

2HVL-RO112B

	Nuclide	Ai	Si	Ki		Li	Mi		Qi	Ci	Ei	CR
			Ai/Sum Ai		KiSi			(Li+1.1Mi)Si	SiQt	(2.12E-3 Qi)/F		CiEi
		Ci/yr		mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrem/yr per uCi/m3	mrad/yr per uCi/m3	mrem/yr per uCi/m3	uCi/sec	uCi/cc	cpm per uCi/cc	cpm
1	Ar-41	0.0E+00	0.00E+00	8.84E+03	0.00E+00	2.69E+03	9.30E+03	0.00E+00	0.00E+00	0.00E+00	3.79E+07	0.00E+00
2	Kr-83m	0.0E+00	0.00E+00	7.56E-02	0.00E+00	0.00E+00	1.93E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3	Kr-85m	0.0E+00	0.00E+00	1.17E+03	0.00E+00	1.46E+03	1.23E+03	0.00E+00	0.00E+00	0.00E+00	3.20E+07	0.00E+00
4	Kr-85	0.0E+00	0.00E+00	1.61E+01	0.00E+00	1.34E+03	1.72E+01	0.00E+00	0.00E+00	0.00E+00	3.60E+07	0.00E+00
5	Kr-87	0.0E+00	0.00E+00	5.92E+03	0.00E+00	9.73E+03	6.17E+03	0.00E+00	0.00E+00	0.00E+00	3.73E+07	0.00E+00
6	Kr-88	0.0E+00	0.00E+00	1.47E+04	0.00E+00	2.37E+03	1.52E+04	0.00E+00	0.00E+00	0.00E+00	3.05E+07	0.00E+00
7	Kr-89	0.0E+00	0.00E+00	1.66E+04	0.00E+00	1.01E+04	1.73E+04	0.00E+00	0.00E+00	0.00E+00	3.72E+07	0.00E+00
8	Kr-90	0.0E+00	0.00E+00	1.56E+04	0.00E+00	7.29E+03	1.63E+04	0.00E+00	0.00E+00	0.00E+00	3.86E+07	0.00E+00
9	Xe-131m	0.0E+00	0.00E+00	9.15E+01	0.00E+00	4.76E+02	1.56E+02	0.00E+00	0.00E+00	0.00E+00	2.44E+07	0.00E+00
10	Xe-133m	0.0E+00	0.00E+00	2.51E+02	0.00E+00	9.94E+02	3.27E+02	0.00E+00	0.00E+00	0.00E+00	2.86E+07	0.00E+00
11	Xe-133	1.0E+00	1.00E+00	2.94E+02	2.94E+02	3.06E+02	3.53E+02	6.94E+02	2.31E+04	1.61E-03	1.80E+07	2.89E+04
12	Xe-135m	0.0E+00	0.00E+00	3.12E+03	0.00E+00	7.11E+02	3.36E+03	0.00E+00	0.00E+00	0.00E+00	7.22E+06	0.00E+00
13	Xe-135	0.0E+00	0.00E+00	1.81E+03	0.00E+00	1.86E+03	1.92E+03	0.00E+00	0.00E+00	0.00E+00	3.86E+07	0.00E+00
14	Xe-137	0.0E+00	0.00E+00	1.42E+03	0.00E+00	1.22E+04	1.51E+03	0.00E+00	0.00E+00	0.00E+00	3.78E+07	0.00E+00
15	Xe-138	0.0E+00	0.00E+00	8.83E+03	0.00E+00	4.13E+03	9.21E+03	0.00E+00	0.00E+00	0.00E+00	3.52E+07	0.00E+00
	Totals =	1.0E+00			2.94E+02			6.94E+02		1.61E-03		2.89E+04

7.35E-05 sec/m3 = x/Q (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)
30556 cfm = Flowrate (From ODCM procedure 1/2-ODC-2.02, Section 8.1.2)

Qt(Total Body) = 500/(x/Q) sum(KiSi) = 2.31E+04 uCi/sec
Qt(Skin) = 3000/(x/Q) sum(Li+1.1Mi)Si = 5.88E+04 uCi/sec
Lowest Qt Value = 2.31E+04 uCi/sec

Ai: Assume 100% Xe-133 (ie; No Source-Term in ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1b
Ki,Li & Mi: From ODCM procedure 1/2-ODC-2.02, Attachment G, Table 2.2-11
Ei: From ODCM procedure 1/2-ODC-2.02, Attachment B, Table 2.1-2b

CR = Sum(CiEi) =	2.89E+04	cpm
Eia = (CR) / (Sum Ci) =	1.80E+07	cpm/uCi/cc
Conversion Factor = 1 / Eia =	5.56E-08	uCi/cc/cpm
DV = CR / Eia =	1.61E-03	uCi/cc
Process HSP = ((CR) x (60%: Site Noble Gas Dose Rate Limit)) / Eia =	9.63E-04	uCi/cc = Process HSP
Process ASP = ((CR) x (30%: Site Noble Gas Dose Rate Limit)) / Eia =	4.82E-04	uCi/cc = Process ASP

NOTE: All equations used above are from ODCM procedure 1/2-ODC-2.02, Section 8.1.2

Trip -- HSP =	9.63E-04	/ (1 + .35 + .10) =	6.64E-04 uCi/cc
Trip -- ASP =	4.82E-04	/ (1 + .35 + .10) =	3.32E-04 uCi/cc

Adjustment of Unit 1 Containment Vacuum Pump Source Term

Due to installation of High Capacity Containment Vacuum Pumps during 1R15 (ECP-02-0079)

Nuclide	Ai OLD VERSION from 1/2-ODC2.02 Attachment A Table 2.1-1a and/or Table 2.2-2a Revision 0 (Ci/yr)	Ai NEW VERSION to 1/2-ODC2.02 Attachment A Table 2.1-1a and/or Table 2.2-2a Revision 1 (Ci/yr)	Ai INCREASE from OLD VERSION to NEW VERSION (Ci/yr)
1 Ar-41	0.0E+00	0.0E+00	0.00E+00
2 Kr-83m	3.7E-04	5.2E-03	4.81E-03
3 Kr-85m	3.9E-03	5.5E-02	5.07E-02
4 Kr-85	7.2E-01	1.0E+01	9.36E+00
5 Kr-87	7.8E-04	1.1E-02	1.01E-02
6 Kr-88	5.0E-03	7.0E-02	6.50E-02
7 Kr-89	3.1E-06	4.3E-05	4.03E-05
8 Kr-90	0.0E+00	0.0E+00	0.00E+00
9 Xe-131m	1.3E-02	1.8E-01	1.69E-01
10 Xe-133m	2.2E-02	3.1E-01	2.86E-01
11 Xe-133	1.9E+00	2.7E+01	2.47E+01
12 Xe-135m	4.4E-05	6.2E-04	5.72E-04
13 Xe-135	1.9E-02	2.7E-01	2.47E-01
14 Xe-137	6.3E-06	8.8E-05	8.19E-05
15 Xe-138	1.2E-04	1.7E-03	1.56E-03
16 I-131	4.7E-04	6.6E-03	6.11E-03
17 I-132	2.5E-06	3.5E-05	3.25E-05
18 I-133	8.4E-05	1.2E-03	1.09E-03
19 I-134	4.7E-07	6.6E-06	6.11E-06
20 I-135	1.4E-05	2.0E-04	1.82E-04
21 Co-58	1.6E-05	2.2E-04	2.08E-04
22 Co-60	7.4E-06	1.0E-04	9.62E-05
23 Mn-54	4.9E-06	6.9E-05	6.37E-05
24 Fe-59	1.6E-06	2.2E-05	2.08E-05
25 Sr-89	3.7E-07	5.2E-06	4.81E-06
26 Sr-90	6.6E-08	9.2E-07	8.58E-07
27 Cs-134	4.9E-06	6.9E-05	6.37E-05
28 Cs-137	8.4E-06	1.2E-04	1.09E-04
29 C-14	0.0E+00	0.0E+00	0.00E+00
NG Totals =	2.7E+00	3.8E+01	3.49E+01
PI Totals =	6.1E-04	8.6E-03	7.99E-03
Sum Totals	2.7E+00	3.8E+01	3.49E+01

5 cfm = Old Containment Vacuum Pump Flowrate used by S&W in SWEC Calculation UR(B)-262

70 cfm = New High Capacity Containment Vacuum Pump Flowrate Documented in ECP-02-0079, DIE 32

14 = Factor of flowrate increase from the old pumps to the new pumps

Ai (OLD VERSION): from ODCM procedure 1/2-ODC-2.02, Attachment A, Table 2.1-1a, Rev 0
These values were developed by S&W in Table 3 of SWEC Calculation UR(B)-262

4. 10080-N-779, “BVPS Unit 1 and Unit 2 Response to a Dam Failure,” Revision 1 including Addendums 1 and 2

Beaver Valley Power Station
CALCULATION COVER SHEET

RTL# A1.002D

Total Pages: ~~12~~ ~~13~~ ~~702~~ 10 9/18/02	Total Pages (incl. Attachments): ~~29~~ ~~30~~ 23 9/18/02

Calculation ☒ Alternate Calculation ☐		Unit: 2	ORGANIZATION: D E
TITLE: BVPS Unit 1 and Unit 2 Response to a Dam Failure			QA Category ☒ I-SR ☐ II ☐ III ☐ F

System	Bldg	Calculation No.	Rev	Add	Seismic: Yes ☐ No ☒
30	INTK	10080-N-779	1	0	

Prepared by/Date Douglas T. Bloom 9-18-02	Checked by/Date 9/19/02 K. TROXLER	Verified by/Date 9/19/02
Approved by/Date KJ Frederick 9/20/02		Type of Design Verification Design Review ☒ Other ☐ Alternate Calc. ☐ None ☐

CROSS REFERENCE DATA

TER	N/A
ECP	02-0721
Condition Report	02-06899
Engineering Memorandum	N/A
Work Order	N/A
Temporary Mod.	N/A
Supersedes Calc, Rev, Add	10080-N-779-0
Supplement Calc, Rev, Add	N/A
Purchase Order No.	N/A
Pipe Line No.	N/A
Cable/Raceway No.	N/A
Computer Program, Rev	RHRCOOL, STER 12.4
Keywords	Dam Failure, Service Water, River Water, Silt level
Referenced Drawings:	N/A
Equipment Asset Nos-EIN	2SWS-P21A/B/C
	1RW-P-1A/B/C

DOCUMENTS AFFECTED:

UFSAR	N/A
Tech Specs	N/A
Operating Manual	1OM-30, 2OM-30
BVPS Calcs	N/A
BVPS Dwgs	N/A
DBD	2DBD-30, 1DBD-30
Vendor Documents	N/A

REVISION STATUS SHEET

Revision Number	Affected Sections	Description of Revision
0	ALL	Original Issue
1	ALL	To address issues in CR 02-06899

1.0 Background

CR 02-07068 raises an issue regarding the minimum requirements for BVPS Unit 1 and Unit 2 (licensing basis/design basis) acceptability of the Ohio River as the ultimate heat sink and the acceptability of the Intake Structure to supply adequate water flow from the river to the suction of the River/Service Water System pumps for conditions which result in lower than normal river water levels.

A detailed multi-person review was completed by Regulatory Affairs on this subject. This extensive review of applicable current and historical information concluded that the licensing basis for the ultimate heat sink for both Unit 1 and Unit 2 is as follows:

> The ultimate heat sink is comprised of the Ohio River, the Intake Structure and the River Water System at Unit 1 and the Service Water System at Unit 2. The ultimate heat sink must be capable of performing its safety function during all expected normal operational transients and during all design basis accidents (DBAs). As per GDC 44, this safety function must have suitable redundancy in components and features to assure that the safety function can be accomplished, assuming a single failure. This single failure can be any active failure in the short run or any passive failure in the long run of any man-made system, structure, or component either on site or offsite. The (passive) failure of a tainter gate on the New Cumberland Dam, as shown in BV1 UFSAR page 2.3-40, is the bounding offsite single failure.
>
> Based upon the above criteria, safety analysis is required to show adequate ultimate heat sink capability for the following two bounding scenarios:

1. A(ny) DBA as the initiating event with either the most limiting onsite single failure or the most limiting offsite single failure and with either only onsite or offsite power. For this scenario the Ohio River Elevation at the start of the DBA would be at level 664.5' msl with the design-minimum river flow rate of 800 cfs, as per BV1 UFSAR Figure 2.3-2. Adequate heat sink must be demonstrated for up to 30 days following the initiating event.A dam failure which is beyond short-term Corp of Engineers' ability to remedy (less than 4 hours) and which results in rapidly decreasing river level would be sufficient basis to cause immediate shutdown of both BVPS units even with river water level still well above 654' msl. Hence a (single) failure of the dam followed by a postulated DBA is not considered a credible event. Additionally, if the dam failure is the initiating event, then a subsequent postulated DBA would be second event, rather than a single failure. Postulating two events occurring near the same time is not required.

2. The failure of the New Cumberland Dam as the initiating event and the most limiting onsite single failure with either only onsite or offsite power. The limiting credible failure for a drought or other normal condition would be the loss of a single tainter gate, which results in a low level of 648.6' msl. The limiting credible failure for a flood condition would be the loss of multiple gates which results in a low level of 654' msl. For this scenario, the licensing basis presumes that there is sufficient time and cooling water flow to fully shutdown the station prior to reaching the low level (basis for the Tech Spec imposition per SRP 2.4.11). The safety analysis would have to demonstrate that the ultimate heat sink retains sufficient long-term residual heat removal capability after both Units are fully shutdown. Adequate heat sink must be demonstrated for up to 30 days following the initiating event. River water and Service Water availability to the plant is limited for this particular scenario by the design of the intake structure. Minimum flow requirements for these systems are provided in the appropriate Unit UFSAR for given accidents. For this particular scenario, neither the RSS heat

exchangers nor the Emergency Diesel Generators are required since it is not required to postulate a Design Basis Accident or Loss of Offsite Power coincident with the dam failure. A single active failure of a River Water/Service Water pump or a residual heat removal pump will be assumed for each unit.

2.0 Objective

The purpose of this calculation is to examine the actual minimum amount of river water/service water flow required to maintain the plant at cold shut down conditions, and compare that value to the amount available to the operable Service Water/River Water pumps. This calculation will also determine the allowable amount of silt build up in the bay based on river flow through the traveling screens and river flow required for the Service Water/River Water systems. This calculation applies to both units.

3.0 Method

The available service water/river water in each bay is calculated based on methodology derived from Stone and Webster Calculations that evaluated flow through the travelling screen from the river into the bay. This will take into account assumptions of river elevation, silt level, and screen plugging amounts.

The available water will then be compared with the required flows. If the available flow is greater than the required flow, stable long term cooling can be achieved. Recommendations will be provided based on the results of the calculation.

For long term cooling considerations, a decay heat value for 70 hours after shutdown is used as the amount of heat required to be removed through the residual heat removal heat exchangers to the primary component cooling water system to the Service Water/River Water system. The STER program was used to evaluate the minimum service water flow required to remove the specified decay heat value.

4.0 Design Inputs

1) Calculation 211-EN-OL-043, Rev. 0
2) Calculation 8700-DMC-2299, Rev. 0
3) Calculation 12241-211-H-1081, Rev. 0
4) Calculation 11-H-5-004, 3/28/74
5) Calculation 10080-N-779, Rev. 0
6) 10080-DMC-0068, Rev. 0
7) Westinghouse Calculation CN-REA-01-35, Rev. 0, dated 8/13/01, "Beaver Valley Decay Heat for Power Uprate Project"
8) Westinghouse Calculation CN-SEE-01-89, Rev. 0, dated 10/31/01, "Beaver Valley 9.4% Uprating Cooldown"
9) BVS-117
10) 2BVS-0012B

5.0 References

1) Unit 1/2 UFSAR sections 2.3 and 2.4 respectively
2) Unit 1/2 SER

3) Condition Report 02-06899
4) 1OM-10, 15, 30
5) 2OM-10, 15, 30
6) Unit 1 & 2 Technical Specifications
7) Engineering Heat Transfer, 1977, Bhalchandra Karlekar and Robert Desmond
8) CR 02-07068
9) CR 02-06954

6.0 Computer Program Description

STER, a heat exchanger shell and tube evaluation program, is used to determine the minimum required service water/river water flows to remove decay heat through the primary component cooling water heat exchangers. This program utilizes standard heat transfer and conservation of mass and momentum equations to calculate values such as outlet temperatures, overall heat transfer coefficient and heat transferred.

Microsoft Excel is used to calculate pertinent equations.

7.0 Assumptions

For conservatism, maximum river temperature of 89 F for Unit 2 and 90 F for Unit 1 are assumed. Also, minimum river level associated with severe drought conditions are assumed. These will provide the lowest river level after tainter gate failure and create the greatest service water/river water flow requirements.

It is assumed that between the time at which the tainter gate fails and the time at which the river reaches the extreme low level of 648.6' (approximately 72 hours), both units are able achieve cold shutdown conditions. This is based on the river elevation over time after a tainter gate failure as described in the Unit 1 UFSAR, Section 2.3, attachment 2.3C. During this period, there are no restrictions for river supply to the service water/river water pumps.

The travelling screen separating the river from each bay is assumed to have 13% of its flow area plugged. This has been established as the BVPS practice through design inputs 1 through 5. This plugging factor can be reasonably assured based on the monthly cleaning frequency of the screens. The only time this assumption may not apply would be during high river level/flooding seasons. However, for the extreme low river scenario, drought conditions are necessary to achieve a low river elevation of 648'7". Therefore, 13% screen plugging is a justifiable assumption. Also, the 13% is assumed to be on both the inlet and outlet of the screen which equates to approximately 20% plugging on one side of the travelling screen.

It is assumed that any bays that are out of service for a maintenance evolution such as bay cleaning can be restored within 72 hours after the initiating event. Discussion with operations has identified that this can be accomplished in approximately 8 hours. This allows for two operable bays to be available when considering a single service water/river water pump failure on each unit.

Acceptance Criteria

The acceptance criteria for this calculation is that the available service water/river water is greater than the required service water/river water needed for long term cooling coincident with a tainter gate failure down stream of the plant.

8.0 Body of Analysis

Flow Into the Bay

The purpose of this calculation is to determine if, after a tainter gate failure of a down stream dam, the river level will be such that adequate SWS/RW supply will be available to provide long term cooling for both Units. This can be accomplished in two steps. The first step will be to find how much flow is available per bay for SWS/RW use. This is limited by the river water elevation and screen head loss and is a function of the allowable silt level. Utilizing the equations derived in design inputs 1 through 4, the following is known.

It can be assumed that any water passing through the travelling screen will be available for pump use in the bay. Design input 3 references a Handbook of Hydraulics which provides the following equation for flow through a system of freely discharging orifices, which is representative of the rear screen. The front screen acts as a system of submerged orifices. The basic governing equation for orifices is as follows.

$Q = C * a * (2 * g * h)^{1/2}$ (Equation 1, D.I. 3)

Where C is the discharge coefficient,
Q is the flow rate in cfs,
a is the cross sectional area in square feet, and
h is the differential head across the orifice in feet.

The variable h is introduced above as the differential head across the orifice in feet. This is better defined as the difference in height between the entrance and exit of the water passing through the screen. This value is the height difference between the silt level and the height drained from the bay by the operating pumps. A variable HL will now be introduced as the difference in height between the top of h and the surface of the river.

Since there are 3 separate unknown variables, 2 more independent equations are needed to solve for Q, h, and HL. The first equation will compare Q with h. Since the rear screen acts as a system of freely discharging orifices with differential heads varying from y = 0 to y = h, an expression relating Q to h can be found by integrating Equation 1 over the range of heads, 0 to h. This provides the following.

$Q = 2/3 * C * L * (2 * g)^{1/2} * h^{3/2}$ (Equation 2, D.I.3)

Flow moving through the travelling screen is dependent on the open flow area through the screen. Design Input 3 provides from drawing 8700-02.075-0004, screen dimensions which include the following. The screen is made up of 12 gauge copper wire (0.105" Diameter) with 3/8" square openings. The length of

the screen is denoted as 14.0 feet (L). The percent of open area (area of a perfectly clean screen that water can pass through) can be found as follows.

% open area = $(0.375''/0.48)^2 * 100 = 61\%$

Also, as stated in the assumptions, a screen plugging of 13 % is assumed. This equates to an open area of 87%.

From the Handbook of Hydraulics, referenced in Design Input 3, the orifice discharge coefficient, C, is taken as 0.9 for submerged square orifices with rounded corners.

$$Q = 0.61 * 0.87 * 2/3 * 0.9 * 14 \text{ feet} * (2 * 32.2 \text{ ft/sec}^2)^{1/2} * h^{3/2}$$

$$Q = 35.77 * h^{3/2}$$

The second independent equation determines the water surface elevation in the river (HL). In order to do this, the head loss through the outside face of the screen must be found. Knowing h & Q, the orifice equation can be used to relate Q with HL. The front screen in this case acts as a submerged orifice so the orifice equation will be used as is.

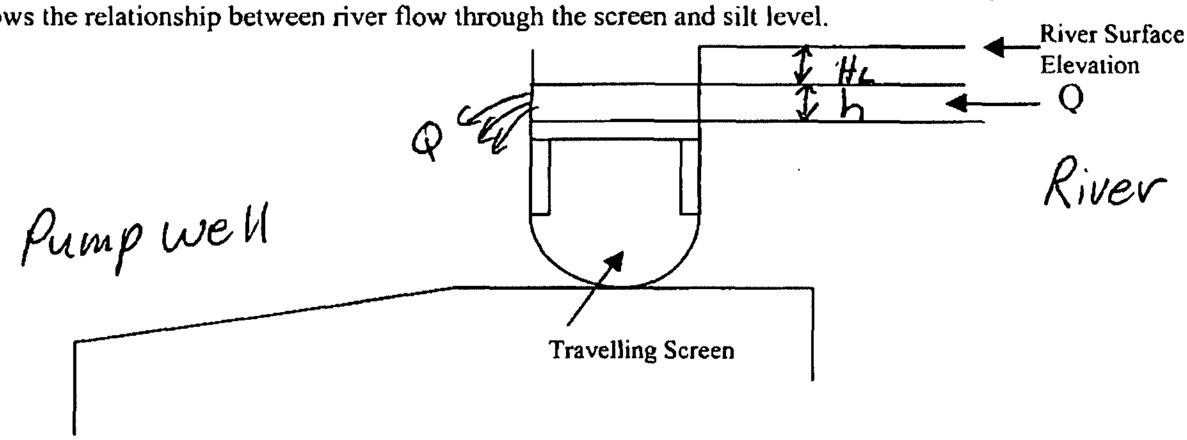
$$Q = C * A * (2 * g * HL)^{1/2}$$

C = 0.9 (see above)

$$A = 14 \text{ feet} * 0.61 * 0.87 * (h + HL)$$

$$Q = 53.66 * (h + HL) * (HL)^{1/2}$$

The two independent equations, combined with the original orifice equation are utilized in an Excel Spreadsheet to iteratively solve for h and HL given an assumed flow rate. Then the flow rate is back calculated after being associated with a specific silt height. The Excel Spreadsheet and the graph of available flow in the bay versus silt height are attached to this calculation. The attached spreadsheet shows that with a level of silt less than or equal to 16.4 inches, a maximum flow rate of 15365 gpm can be obtained from the river at an elevation of 648'7". The 16.4 inches is coincident with the top of the traveling screen lip, below which, no flow may pass. Attachment 1, page 3 provides a figure, which shows the relationship between river flow through the screen and silt level.



Minimum required flows for Unit 1 are given in UFSAR Table 9.9-3, River Water System Flow Conditions. For a design basis accident coincident with a loss of offsite power, the river water system is required to provide 8470 gpm of river water to safety related components. However, for the dam-low river elevation scenario, neither a LOOP or design basis accident can be assumed as coincident so the Recirculation Spray Heat Exchangers (8000 gpm) and the Emergency Diesel Generators (350 gpm) are not required as loads. Therefore, only the charging pump lube oil coolers (20 gpm) and the control room cooling coils (100 gpm) are required for a safe shut down. These provide a total 120 gpm plus the CCW loads for unit 1.

Minimum required flows for Unit 2 are given in UFSAR Table 9.2-2, Service Water System Flow Requirements. For a Loss of Offsite Power, the service water system is required to provide 6909 gpm to the safety-related components in the system. However, for the dam – low river elevation scenario, a LOOP is not assumed to be coincident with the dam failure, therefore, the diesel generator flow of 625 gpm is not required. This leaves the required loads for the charging pump lube oil cooler (20 gpm), Safeguards AC Unit (100 gpm), Control Room Cooling (100 gpm), Alternate Shutdown Panel (17 gpm), MCC coolers (5 gpm), and the pump seals/motor cooler/strainer backwash (50 gpm). The above gives a total of 292 gpm plus primary component cooling water system loads.

Long Term Cooling

The purpose of this calculation is to ensure adequate flow is available for long term cooling. The minimum flow required for long term cooling is assumed to be required approximately 72 hours after dam failure and shut down initiation. This, in accordance with section 2.3 of the Unit 1 UFSAR, is when the river will have reached its minimum level of 648.6 feet.

The decay heat value present at this time is obtained from design input 7. The decay heat will be approximately 12.2 MW, which converts to 41,626,400 BTU/hr. This value is divided among the active RHR heat exchangers giving a heat load of 20,813,200 BTU/hr per heat exchanger. This single heat exchanger heat load was the target heat transfer value for iterative STER program runs varying the service water/river water flow rates to achieve the minimum required flow rate to remove the specified heat load.

Data assumed for the primary component cooling water heat exchangers in the STER runs are as follows: Mass flow rate of the Unit 1 primary component cooling water is 2,000,000 lbm/hr (Design Input 13). Inlet temperature of the river water is 90 F and outlet temperature of the Unit 1 primary component cooling water is 124 F (design input 8). Mass flow rate of the Unit 2 primary component cooling water is 2,500,000 lbm/hr (design input 10). Inlet temperature of the service water is 89 F and the outlet temperature of the Unit 2 primary component cooling water is 120 F (design input 8). Design values taken from the vendor specifications (design inputs 9 and 10) are utilized as the pertinent data for the heat exchanger evaluation.

Further information was required as input to STER. The inlet temperatures for both the shell and the tube side are required, however, only the tube side inlet temperatures were known. Using standard heat exchanger and mass/energy balance equations about the primary component cooling water heat exchangers:

$Q = m * cp * (Th - Tc)$, $Q = U * A * LMTD$ and

$LMTD = ((Thi-Tci)-(Tho-Tco))/LN((Thi-Tci)/(Tho-Tco))$

Where m is the mass flow rate for the specific shell or tube fluid in pounds per hour,

cp is the specific heat of the fluid (1.0 for this analysis), and

Th and Tc are the inlet and outlet temperatures of the heat exchanger (hot and cold) respectively.

U is the overall heat transfer coefficient and A is the heat transfer surface area in square feet.

LMTD is the log mean temperature difference in F.

For this analysis, Thi is the CCP inlet temperature, Tci is the service water/river water inlet temperature,

Tho is the CCP outlet temperature and Tco is the service water/river water outlet temperature.

First, LMTD is calculated using LMTD = Q/(UA).

Then the inlet CCP temperature is solved for using the mass-energy equation Tci = Tco + Q/(m*cp)

This temperature value was calculated for both units yielding 134.4 F for Unit 1 and 128.33 F for Unit 2.

9.0 Results

The STER outputs attached to this calculation as attachments 2 and 3 show that the minimum required river water flow rate for Unit 1 is 1408.93 gpm per CCP heat exchanger, and the minimum required service water flow rate for unit 2 is 1448.73 gpm per heat exchanger. Approximately 1500 gpm river water/service water flow is required per operating heat exchanger (a minimum of 2 heat exchangers per unit are assumed to be operating).

Attachment 1, page 3 shows the available flow per bay based on the current silt level at a river elevation of 648.6'.

10.0 Conclusion

In order to maintain cold shutdown and cooling of essential loads, a minimum service water/river water flow rate of 3120 gpm for Unit 1 and 3292 gpm for unit 2 is required per operating train. However, 2OM-30 provides minimum flow limits for the Unit 2 service water pumps. It states that a flow rate of 7500 gpm can only be maintained for 4 months without expected pump degradation.

In accordance with attachment 1, page 3, 7500 gpm flow through a travelling screen corresponds to a silt limit of 22 inches. In order to protect the service water pumps from a lack of suction head, a silt limit of 22 inches shall be established, above which, bay operability shall be questioned. Also, bay flow limits of 7500 gpm shall be established to protect to protect the pumps from operating below minimum flow requirements and limit pump flow based on the available flow into the bay through the travelling screens to a value corresponding to the maximum allowable silt limit of 22 inches. These limitations are required when river elevation is below 650'.

The current bay cleaning procedures state that if the as-found silt levels are in excess of 15 inches, the bay should be clean. It is recommended that this limit remain, however, if the operability limit of 22 inches is exceeded, a condition report shall be written and addressed accordingly.

C	0.9
%open	0.61
A%	0.87
L	14
Q	15365
C'	35.77
h	0.97
C"	53.66
HL	0.265945
Q"	15365
h+HL	1.237

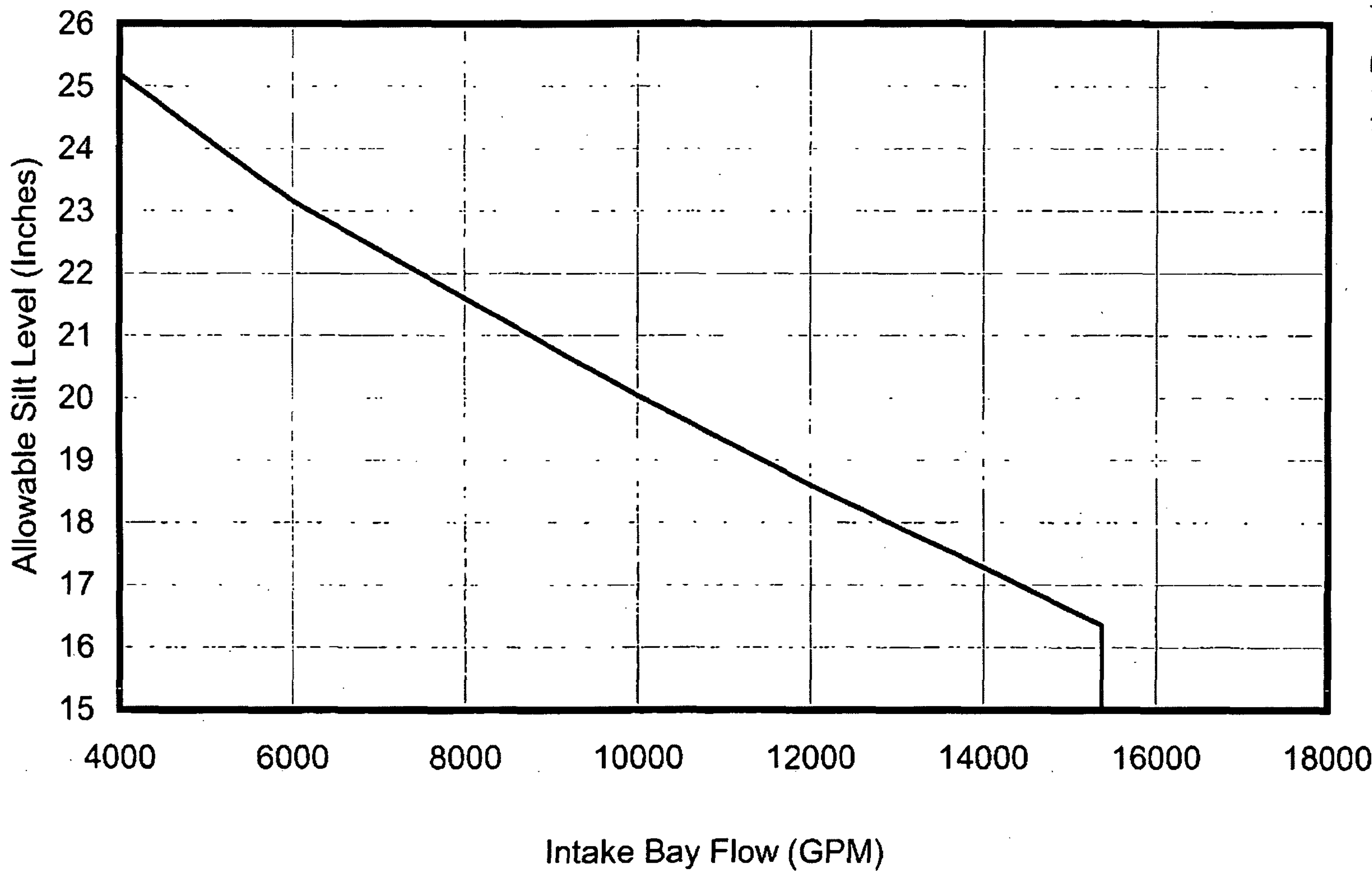
	H(.87)	Max Silt	Silt Depth
4000	0.50	648.1000	25.2
6000	0.67	647.9300	23.2
8000	0.80	647.8000	21.6
10000	0.93	647.6700	20.0
12000	1.05	647.5500	18.6
14000	1.16	647.4400	17.3
15000	1.22	647.3830	16.6
15365	1.24	647.3630	16.4
15365	1.37	647.2300	14.8

10080-N-779-1
Att. 1
Pg1

C	0.9				
%open	0.61				
A%	0.87		H(.87)	Max Silt	Silt Depth
L	14	4000	0.5	=648.6-G4	=(H4-646)*12
Q	15365	6000	0.67	=648.6-G5	=(H5-646)*12
C'	=D1*D2*D3*D4*0.66667*SQRT(64.4)	8000	0.8	=648.6-G6	=(H6-646)*12
h	=(D5/(7.481*60*D6))^0.66667	10000	0.93	=648.6-G7	=(H7-646)*12
C"	=D6*1.5	12000	1.05	=648.6-G8	=(H8-646)*12
HL	0.26594548586369	14000	1.16	=648.6-G9	=(H9-646)*12
Q"	=7.481*60*D8*(D7+D9)*D9^0.5	15000	1.217	=648.6-G10	=(H10-646)*12
		15365	1.237	=648.6-G11	=(H11-646)*12
h+HL	=D9+D7	15365	1.37	=648.6-G12	=(H12-646)*12

10080-N-779-1
Att.1
pg2

Allowable Silt Level vs Intake Bay Flow



10080-N-779-1
Att. 1
pg 3

10080-N-779-1 ATT.2
pg 1

STER - 4.12 1CCE1.doc

SHELL AND TUBE HEAT EXCHANGER RATING PROGRAM

Mode of Operation: PERFORMANCE PREDICTION
Name of Data File: H:2CCS-E21.PPS
File Description: 380 tubes plugged

Component Identification: CC-E-1A
Component Description: unit 1 ccr hx
Method of calculation: DESIGN POINT

This report was created on: 9/19/2002 at 8:37:13.56

10080-N-729-1, Att.2
pg2

STER - 4.12 9/19/2002 at 8:37:13

Mode of Operation: PERFORMANCE PREDICTION
Name of Data File: H:2CCS-E21.PPS
File Description: 380 tubes plugged

Component Identification: CC-E-1A
Component Description: unit 1 ccr hx
Method of calculation: DESIGN POINT

***** EQUIPMENT CONFIGURATION *****

PARAMETER	VALUE
Number of shells in series/parallel	1/ 1
Shell type	E
Number of tube passes	1
Number of tubes(holes in tubesheet)	748
Tube outside diameter, inches	.7500
Tube wall thickness, inches	.0370
Tube material: 304 STAINLESS STEEL	
Tube material thermal conductivity,Btu/hr/ft/	8.83
Tubeside inlet nozzle diameter, inches	18.00
Tubeside outlet nozzle diameter, inches	18.00
Effective H.T. surface area, ft^2	5970.0
Eff. Tube Length (ft.)	40.648

QA REFERENCES

********* DESIGN POINT **********

PARAMETER	TUBESIDE	SHELLSIDE
Temperature, deg F inlet/outlet	83.00 / 102.30	151.50 / 123.50
Flow rate, 1000 LB/HR	2900.00	2000.00
Pressure drop, psi	10.00	13.00
Fouling resistance, (1/Btu/Hr/ft^2/F)	.001500	.000500
Overall h.t. coefficient	224.00	
Shellside h.t. coeff. (finned tubes only)	.00	

QA REFERENCES

spec sheet U value- 10% tube plugging

10080-N-779-1, Att.2
pg3

STER - 4.12 9/19/2002 at 8:37:13

Mode of Operation: PERFORMANCE PREDICTION
Name of Data File: H:2CCS-E21.PPS
File Description: 380 tubes plugged

Component Identification: CC-E-1A
Component Description: unit 1 ccr hx
Method of calculation: DESIGN POINT

OUTPUT DATA

Procedure # decay heat Date: 09/19/02

*** OFF DESIGN OUTPUT DATA ***

PARAMETER	TUBESIDE	SHELLSIDE
Fluid type	WATER	WATER
Temperature, deg F inlet/outlet	90.00 / 119.92*	134.40 / 123.94*
Flow rate, (1000 Lbm/hr)/(GPM)	700.00 / 1408.93	2000.00 / 4048.15
Operating pressure, psig	50.00	100.00
Heat transfer coefficient, Btu/F/ft^2/hr	544.71*	765.30*
Pressure drop, psi	.71*	13.00*
Fouling resistance, (1/Btu/Hr/ft^2/F)	.001500	.000500
Reynolds Number	15076.*	0.*

Heat Duty, Btu/hr-----------> 20885250.*
Overall h.t. coefficient----------->170.21*
Effective h.t. surface area per unit, ft^2--------> 5371.4*
LMTD----> 22.84*
Corrected LMTD----> 22.84*
Tubeside velocity, ft/sec---------> 1.8724*

Fluid property code	1	1
Reference temperatures, F	104.96	129.17
Density, lbm/ft^3	61.943	61.596
Specific Heat capacity, Btu/lbm F	.998	.999
Thermal conductivity, Btu/hr ft F	.3654	.3745
Absolute viscosity, cP	.645	.509

NOTE: Tubeside fouling refers to inside tube surface
Shellside fouling refers to outside tube surface
* - Indicates values calculated by STER.

10080-N-779-1, ATT. 3
pg1

2CCPE211.doc

STER - 4.12

SHELL AND TUBE HEAT EXCHANGER RATING PROGRAM

This computer code is QA validated under Holtec International's QA program

Mode of Operation: PERFORMANCE PREDICTION
Name of Data File: H:2CCP-E21.PPS
File Description: 10% tubes plugged

Component Identification: U2CCP
Component Description: unit 2 ccp hx evaluation
Method of calculation: DESIGN POINT

This report was created on: 9/19/2002 at 8:57:35.16

Mode of Operation: PERFORMANCE PREDICTION
Name of Data File: H:2CCP-E21.PPS
File Description: 10% tubes plugged

Component Identification: U2CCP
Component Description: unit 2 ccp hx evaluation
Method of calculation: DESIGN POINT

***** EQUIPMENT CONFIGURATION *****

PARAMETER	VALUE
Number of shells in series/parallel	1/ 1
Shell type	E
Number of tube passes	1
Number of tubes(holes in tubesheet)	956
Tube outside diameter, inches	.6250
Tube wall thickness, inches	.0490
Tube material: 304 STAINLESS STEEL	

Tube material thermal conductivity,Btu/hr/ft/	8.81
Tubeside inlet nozzle diameter, inches	20.00
Tubeside outlet nozzle diameter, inches	20.00
Effective H.T. surface area, ft^2	6251.0
Eff. Tube Length (ft.)	39.962

QA REFERENCES

bvs-12b
2Hx

********* DESIGN POINT **********

PARAMETER	TUBESIDE	SHELLSIDE
Temperature, deg F inlet/outlet	83.00 / 108.00	135.00 / 120.00
Flow rate, 1000 LB/HR	2500.00	2500.00
Pressure drop, psi	10.20	14.00
Fouling resistance, (1/Btu/Hr/ft^2/F)	.001000	.000500
Overall h.t. coefficient	272.00	
Shellside h.t. coeff. (finned tubes only)	.00	

QA REFERENCES

bvs-12b

STER - 4.12 9/19/2002 at 8:57:35

Mode of Operation: PERFORMANCE PREDICTION
Name of Data File: H:2CCS-E21.PPS
File Description: 380 tubes plugged

Component Identification: U2CCP
Component Description: unit 2 ccp hx evaluation
Method of calculation: DESIGN POINT

OUTPUT DATA

Procedure # decay heat Date: 09/19/02

*** OFF DESIGN OUTPUT DATA ***

10080-N-779-1, Att. 3
pg3

PARAMETER	TUBESIDE	SHELLSIDE
Fluid type	WATER	WATER
Temperature, deg F inlet/outlet	89.00 / 118.04*	128.33 / 117.88*
Flow rate, (1000 Lbm/hr)/(GPM)	720.00 / 1448.73	2000.00 / 4017.72
Operating pressure, psig	50.00	100.00
Heat transfer coefficient, Btu/F/ft^2/hr	712.74*	989.45*
Pressure drop, psi	1.04*	8.96*
Fouling resistance, (1/Btu/Hr/ft^2/F)	.001000	.000500
Reynolds Number	15331.*	0.*

Heat Duty, Btu/hr-----------> 20830590.*
Overall h.t. coefficient----------->205.62*
Effective h.t. surface area per unit, ft^2--------> 5623.3*
LMTD----> 18.02*
Corrected LMTD----> 18.02*
Tubeside velocity, ft/sec---------> 2.4791*

	TUBESIDE	SHELLSIDE
Fluid property code	1	1
Reference temperatures, F	103.52	123.11
Density, lbm/ft^3	61.962	62.063
Specific Heat capacity, Btu/lbm F	.998	.998
Thermal conductivity, Btu/hr ft F	.3649	.3724
Absolute viscosity, cP	.655	.539

NOTE: Tubeside fouling refers to inside tube surface
Shellside fouling refers to outside tube surface
* - Indicates values calculated by STER.

RTL# A1.002D

Calculation Affected Document Review Checklist

Calculation: 10080-N-779 Revision: 1 Addendum: 0

Do the Calculation Assumptions and/or Conclusions affect:

		YES	NO	DOCUMENT/SECTION
1.	The UFSAR?	☐	☒	
2.	Technical Specifications?	☐	☒	
3.	Design Basis Documents?	☒	☐	2DBD-30 / 1DBD-30
4.	The Operating Manual?*	☒	☐	2OM-30 / 1OM-30
5.	The Abnormal Operating Procedures?*	☒	☐	as appropriate in #4
6.	Emergency Procedures?*	☐	☒	
7.	OST/BVT Procedures?*	☐	☒	
8.	The ISI/IST Program?*	☐	☒	
9.	Other Plant Procedures?*	☐	☒	
10.	Equipment Setpoints?*	☐	☒	
11.	Other BVPS Calculations?	☐	☒	
12.	Vendor Calculations?	☐	☒	
13	Other VTIs?*	☐	☒	
14.	Equipment Specifications?	☐	☒	
15.	Procurement Specifications?	☐	☒	
16.	The Fire Protection Safe Shutdown Report?	☐	☒	
17.	The EQ Program?	☐	☒	
18.	Any other Design Basis documents?	☐	☒	
19.	Any radiological inputs and/or consequences?	☐	☒	

* When these items are checked YES, list the Engineering Change Package number that will update or track the update of the affected document(s). Attach this Checklist to the Calculation to document this review.

ECP 02-0721

FirstEnergy

DESIGN VERIFICATION RECORD

NOP-CC-2001-01 Rev. 00

SECTION I: TO BE COMPLETED BY DESIGN ORIGINATOR

DOCUMENT(S)/ACTIVITY TO BE VERIFIED:

10080-N-779, Rev. 1, BVPS Unit 1 and Unit 2 Resposnse to a Dam Failure

☒ SAFETY RELATED ☐ AUGMENTED QUALITY ☐ NONSAFETY RELATED

SUPPORTING/REFERENCE DOCUMENTS

DESIGN ORIGINATOR: *(Print and Sign Name)*	DATE
D T Bloom [signature]	9-20-02

SECTION II: TO BE COMPLETED BY VERIFIER

VERIFICATION METHOD *(Check one)*

☒ DESIGN REVIEW *(Complete Design Review Checklist or Calculation Review Checklist)* ☐ ALTERNATE CALCULATION ☐ QUALIFICATION TESTING

JUSTIFICATION FOR SUPERVISOR PERFORMING VERIFICATION:

APPROVAL: *(Print and Sign Name)*	DATE

EXTENT OF VERIFICATION:

Calc Checklist

COMMENTS, ERRORS OR DEFICIENCIES IDENTIFIED? ☐ YES ☐ NO

RESOLUTION: *(For Alternate Calculation or Qualification Testing only)*

RESOLVED BY: *(Print and Sign Name)*	DATE
VERIFIER: *(Print and Sign Name)*	DATE
K. TROXLER [signature]	9/19/02
APPROVED BY: *(Print and Sign Name)*	DATE
K.J Frederick [signature]	9/20/02

FirstEnergy

CALCULATION REVIEW CHECKLIST

NOP-CC-2001-04 Rev. 00

CALCULATION NO. U-779

REV. 1

UNIT 1 & 2

QUESTION	NA	Yes	No	COMMENTS	RESOLUTION
REFERENCES					
1 Does the stated objective/purpose clearly describe why the calculation is being performed?		✓			
2. Are applicable codes, standards, design/licensing basis documents, etc., including edition and addenda where appropriate clearly identified?		✓			
3. Do the references reflect the appropriate revision?		✓			
INPUTS					
4. Are design inputs clearly identified and their source documents referenced, including revision level as appropriate?		✓			
5. Are the design inputs relevant, current, consistent with design/licensing bases and directly applicable to the purpose of the calculation, including appropriate tolerances and ranges/modes of operation?		✓			
6. Are all design inputs retrievable? If not, have they been added as attachments?		✓			
7. Are preliminary or conceptual inputs clearly identified for later confirmation as open assumptions?	✓				
ASSUMPTIONS					
8. Have the assumptions necessary to perform the analysis been adequately documented?		✓			
9. Is suitable justification provided for all assumptions (except those based upon recognized engineering practice, physical constants or elementary scientific principles)?		✓			
10. Are all assumptions for the calculation reasonable and consistent with design/licensing bases?		✓			
11. Have all open assumptions needing later confirmation been clearly identified on the Calculation cover sheet, including when the open assumption needs to be closed?	✓				
12. Has a Condition Report been issued for open assumptions if required?	✓				
13. Have engineering judgments been used?		✓			
14. Are engineering judgments reasonable and adequately documented?		✓			
METHOD OF ANALYSIS					
15. Is the method used appropriate considering the purpose and type of calculation?		✓			
16. Is the method in accordance with applicable codes, standards, and design/licensing bases?		✓			
IDENTIFICATION OF COMPUTER CODES (Ref: NOP-SS-1001)					
17. Have the versions of the computer codes employed in the design analysis been certified for this application?		✓			
18. Are codes properly identified along with source, inputs and outputs?		✓			
19. Is the code suitable for the analysis being performed?		✓			
20. Does the computer model, that has been created, adequately reflect actual (or to be modified) plant conditions (e.g., dimensional accuracy, type of model/code options used, time steps, etc.)?		✓			
21. Is the computer output reasonable when compared to inputs and what was expected?		✓			
COMPUTATIONS					
22. Are the equations used consistent with recognized engineering practice and design/licensing bases?		✓			
23. Is justification provided for any equations not in common use?	✓				
24. Is the justification reasonable?	✓				
25. Have adjustment factors, uncertainties, empirical correlations, etc., used in the analysis been correctly applied?	✓				
26. Is the result presented with proper units and tolerance?		✓			
27. Has proper consideration been given to results that may be overly sensitive to very small changes in input?	✓				

FirstEnergy	CALCULATION REVIEW CHECKLIST NOP-CC-2001-04 Rev. 00	Page 2 of 2 CALCULATION NO. N-779 REV. 1 UNIT 1 & 2

QUESTION	NA	Yes	No	COMMENTS	RESOLUTION
CONCLUSIONS					
28. Is the magnitude of the result reasonable when compared to inputs?		✓			
29. Is the direction of trends reasonable?	✓				
30. Are stated conclusions justifiable based on the calculation results?		✓			
31. Are all pages sequentially numbered and marked with a valid calculation number?		✓			
32. Is all information legible and reproducible?		✓			
33. Have all changes in the documentation been initialed (or signed) and dated by the author of the change and all required reviewers?		✓			
34. Have all calculation results stayed within existing design/licensing basis parameters?		✓			
35. If the response to Question 34 is NO, has Licensing been notified as appropriate? (i.e. UFSAR or Tech Spec Change Request has been initiated).	✓				
36. Does the calculation meet its purpose/objective?		✓			
37. Has the calculation vendor used all applicable design information/requirements provided?	✓				
38. Did the calculation vendor determine if the calculation was referenced in design basis documents and/or databases?	✓				
39. Did the Preparer determine if the calculation was used as a reference in the UFSAR?	✓				
40. If the calculation is used as a reference in the UFSAR, is a change to the UFSAR required or an update to the UFSAR Validation Database, if applicable, required?	✓				
41. If the answer to Question 40 is YES, have the appropriate documents been initiated?	✓				
42. Is the calculation acceptable for use?		✓			
43. What checking method was used to review the calculation? Check all that apply.					
• spot check for math		✓			
• complete check for math					
• comparison with tests					
• check by alternate method					
• comparison with previous calculation					

Review Summary:

☒ **Technical Review**		☐ **Owner's Acceptance Review** *(Required for calculations prepared by a vendor)*	
Reviewer *(Print and Sign Name)* K. TROXLER K Troxler	Date 9/19/02	Reviewer: *(Print and Sign Name)*	Date
		Approver: *(Print and Sign Name)*	Date

Beaver Valley Power Station
CALCULATION COVER SHEET

RTL# A1.002D

Total Pages: 11	Total Pages (incl. Attachments): ~~46~~ 45 [initials] 10-23-02

Calculation ☒	Alternate Calculation ☐		Unit: 1/2		ORGANIZATION: DE
TITLE: BVPS Units 1 and 2 Response to a Dam Failure					QA Category ☒ I-SR ☐ II ☐ III ☐ F
System	Bldg	Calculation No.	Rev	Add	Seismic: Yes ☐ No ☒
30	INTK	10080-N-779	1	1	

Prepared by/Date [signature] 10-02 Douglas T. Bloom	Checked by/Date 10/17/02 K. TROXLER [signature]	Verified by/Date [signature] 10/17/02
Approved by/Date		Type of Design Verification
K.J. Frederick [signature] 10/24/02		Design Review ☒ Other ☐ Alternate Calc. ☐ None ☐

CROSS REFERENCE DATA

TER	N/A
ECP	02-0721
Condition Report	02-06899
Engineering Memorandum	N/A
Work Order	N/A
Temporary Mod.	N/A
Supersedes Calc, Rev, Add	N/A
Supplement Calc, Rev, Add	10080-N-779-1
Purchase Order No.	N/A
Pipe Line No.	N/A
Cable/Raceway No.	N/A
Computer Program, Rev	Flomap PC, STER 4.12
Keywords	Recirculation Spray, Design Basis Accident, Dam Failure, Bay Limitation, Silt
Referenced Drawings:	N/A
Equipment Asset Nos-EIN	1WR-P-1A/B/C
	1RS-E-1A/B/C/D
	2SWS-P21A/B/C
	2RSS-E21A/B/C/D

DOCUMENTS AFFECTED:

UFSAR	N/A
Tech Specs	N/A
Operating Manual	1OM-30, 2OM-30, AOP for Low River Level
BVPS Calcs	N/A
BVPS Dwgs	N/A
DBD	N/A
Vendor Documents	N/A

REVISION STATUS SHEET

Revision Number	Affected Sections	Description of Revision
0	ALL	Original Issue
1	ALL	To address issues in CR 02-06899
Add. 1	ALL	To address DBA/RSS SW flow throttling issues

1.0 Background

CR 02-07068 raises an issue regarding the minimum requirements for BVPS Unit 1 and Unit 2 (licensing basis/design basis) acceptability of the Ohio River as the ultimate heat sink and the acceptability of the Intake Structure to supply adequate water flow from the river to the suction of the River/Service Water System pumps for conditions which result in lower than normal river water levels.

A detailed multi-person review was completed by Regulatory Affairs on this subject. This extensive review of applicable current and historical information concluded that the licensing basis for the ultimate heat sink for both Unit 1 and Unit 2 is as follows:

> The ultimate heat sink is comprised of the Ohio River, the Intake Structure and the River Water System at Unit 1 and the Service Water System at Unit 2. The ultimate heat sink must be capable of performing its safety function during all expected normal operational transients and during all design basis accidents (DBAs). As per GDC 44, this safety function must have suitable redundancy in components and features to assure that the safety function can be accomplished, assuming a single failure. This single failure can be any active failure in the short run or any passive failure in the long run of any man-made system, structure, or component either on site or offsite. The (passive) failure of a tainter gate on the New Cumberland Dam, as shown in BV1 UFSAR page 2.3-40, is the bounding offsite single failure.
>
> Based upon the above criteria, safety analysis is required to show adequate ultimate heat sink capability for the following two bounding scenarios:

1. A(ny) DBA as the initiating event with either the most limiting onsite single failure or the most limiting offsite single failure and with either only onsite or offsite power. For this scenario the Ohio River Elevation at the start of the DBA would be at level 664.5' msl with the design-minimum river flow rate of 800 cfs, as per BV1 UFSAR Figure 2.3-2. Adequate heat sink must be demonstrated for up to 30 days following the initiating event.A dam failure which is beyond short-term Corp of Engineers' ability to remedy (less than 4 hours) and which results in rapidly decreasing river level would be sufficient basis to cause immediate shutdown of both BVPS units even with river water level still well above 654' msl. Hence a (single) failure of the dam followed by a postulated DBA is not considered a credible event. Additionally, if the dam failure is the initiating event, then a subsequent postulated DBA would be second event, rather than a single failure. Postulating two events occurring near the same time is not required.

2. The failure of the New Cumberland Dam as the initiating event and the most limiting onsite single failure with either only onsite or offsite power. The limiting credible failure for a drought or other normal condition would be the loss of a single tainter gate, which results in a low level of 648.6' msl. The limiting credible failure for a flood condition would be the loss of multiple gates which results in a low level of 654' msl. For this scenario, the licensing basis presumes that there is sufficient time and cooling water flow to fully shutdown the station prior to reaching the low level (basis for the Tech Spec imposition per SRP 2.4.11). The safety analysis would have to demonstrate that the ultimate heat sink retains sufficient long-term residual heat removal capability after both Units are fully shutdown. Adequate heat sink must be demonstrated for up to 30 days following the initiating event. River water and Service Water availability to the plant is limited for this particular scenario by the design of the intake structure. Minimum flow requirements for these systems are provided in the appropriate Unit UFSAR for given accidents. For this particular scenario, neither the RSS heat

exchangers nor the Emergency Diesel Generators are required since it is not required to postulate a Design Basis Accident or Loss of Offsite Power coincident with the dam failure. A single active failure of a River Water/Service Water pump or a residual heat removal pump will be assumed for each unit.

2.0 Objective

The base calculation for this addendum, 10080-N-779-1, calculated the bay limitations for the river water and service water pumps with regard to a tainter gate failure of the New Cumberland Dam. The purpose of this addendum is to evaluate the loads proposed to be throttled to ensure the bay limitation of 7500 gpm per bay is not violated. This calculation will ensure that the throttled loads are capable of performing their design functions under any operating condition at a reduced flow. This calculation will also provide a basis for the 13% screen blockage factor used in the bay flow limitation calculation in the base calculation.

3.0 Method

The purpose of this calculation is to determine the amount of throttling, river water and service water components must apply to their cooling supply provided by the ultimate heat sink in order to meet bay flow limitations for extreme low river conditions. This is performed by utilizing the dual-train, river water and service water, Flomap models obtained from design inputs 16 and 17. The Flomap models will be performed iteratively, reducing flow through the Recirculation Spray Heat Exchangers until both operating pumps for each unit meet the bay limitation of 7500 gpm.

This recirculation spray heat exchanger throttled flow value will be evaluated using the STER program, a shell and tube heat exchanger evaluation program, in conjunction with referenced containment sump conditions following a Loss of Coolant Accident.

Finally, the 13% screen blockage factor is evaluated with regard to river elevation and solid blockage level of the screens. This evaluation utilizing the general flow through orifices equation will determine if the 6" differential pressure alarm across the screen is adequate or if additional steps should be taken in the low river level AOP to ensure screen cleanliness.

4.0 Design Inputs

1) Calculation 10080-N-779, Rev. 1
2) Westinghouse Calculation CN-REA-01-35, Rev. 0, dated 8/13/01, "Beaver Valley Decay Heat for Power Uprate Project"
3) BVS-139
4) 2BVS-12A
5) 8700-DMC-2353-1, "Evaluation of Tube Plugging Limits for the Recirculation Spray Heat Exchangers at Beaver Valley Unit 1"
6) 10080-DMC-0696-0, "RSS Heat Exchanger Delta-P at Various Tube Plugging Levels"
7) Test Data from 1BVT 2.30.1 on 4/10/02
8) Test Data from 1BVT 2.30.2 on 12/20/01
9) 2OST-30.2, Rev. 25
10) 2OST-30.3, Rev. 25

11) Unit 1 UFSAR Figure 14.3-58
12) 10080-US(B)-223-1, Add. 2: LOCTIC Output
13) Letter ND1MLM: 0237 dated April 29, 2002, "Containment Analysis Inputs"
14) 10080-RT-113 drawing series, Revision 5
15) 8700-RT-113 drawing series, Revision 5
16) 8700-DMC-3136-2, Add. 3
17) 10080-N-785-2, Add. 2
18) 8700-DMC-2339-1

5.0 References

1) Unit 1/2 UFSAR sections 2.3 and 2.4 respectively
2) Unit 1/2 SER
3) Condition Report 02-06899
4) 1OM- 30
5) 2OM- 30
6) Unit 1 & 2 Technical Specifications
7) Introduction to Nuclear Engineering, Lamarsh
8) Fundamentals of Heat and Mass Transfer, Incropera and DeWitt

6.0 Computer Program Description

FloMap.PC 1.0 is an interactive program to aid engineers in the design and analysis of steady-state piping networks using a non-compressible fluid. The analytical processing of FloMap is divided into two distinct algorithms: a hydraulic calculation and a thermal calculation. In the hydraulic calculation, FloMap determines the set of steady state continuity equations and Bernoulli loop equations that apply to the network. These equations are solved iteratively to yield a flow and pressure distribution for the network by following the principles of conservation of mass and momentum. The friction factor is adjusted during the solution process based on the calculated Reynolds number. The hydraulic calculation is considered converged when the change in flow rate between successive iterations is less than the criteria for that calculation (0.01 gpm in this analysis). Since this problem was analyzed as an isothermal problem, the thermal calculation portion of the code was not used.

STER, a heat exchanger shell and tube evaluation program, is used to determine the minimum required service water/river water flows to remove decay heat through the primary component cooling water heat exchangers. This program utilizes standard heat transfer and conservation of mass and momentum equations to calculate values such as outlet temperatures, overall heat transfer coefficient and heat transferred.

7.0 Assumptions

For conservatism, maximum river temperature of 89 F for Unit 2 and 90 F for Unit 1 are assumed. Also, minimum river level associated with severe draught conditions are assumed. These will provide the lowest river level after a failure of the tainter gate at the New Cumberland Dam and create the greatest service water/river water flow requirements.

In accordance with the licensing basis, a passive failure of the dam gate is assumed to happen 24 hours after the initiation of the design basis accident. In addition to this, there will be a period of time before the river level drops to elevation 648.6' as per Unit 1 UFSAR attachment 2.3C on page 2.3-40. According to the figure on page 2.3-40, upon failure of the dam gate, the river will take approximately 43 hours to go from the plant design basis river elevation of 654' to 648.6'. A total of 67 hours exists after the initiation of the design basis accident before bay flow limits will be required.

The heat load for the Recirculation Spray Heat exchangers is derived from design input 2, utilizing a decay heat value from the core, 3 hours after the accident initiation for Unit 1 and 6 hours after accident initiation for Unit 2. These values are chosen because they are the latest available data points in the unit specific containment analyses. This is conservative when compared to the 67 hours mentioned above since decay heat decreases exponentially over time.

According to design input 2, 3 hours after shutdown provides a decay heat value of 29.2 MW or 99,630,400 BTU/hr. This total heat load value is assumed to be released in its entirety to the containment atmosphere where the spray removes the heat from the atmosphere and delivers it to the containment sump. In the sump, two RSS trains or four recirculation spray heat exchangers divide the total heat load evenly among themselves. This equates to a minimum required heat load of 49,815,200 BTU/hr per recirculation spray heat exchanger train (2 heat exchangers per train, one or both may be operating). This heat load value is conservative because the full amount will not escape the RCS, nor will it be completely captured by the spray. This value is over double what would actually be present at the 67 hour time frame where throttling of the RSS heat exchanger River Water/Service Water is expected to occur (21,325,000 BTU/hr per train or 10,662,500 BTU/hr per heat exchanger).

According to design input 2, 6 hours after shutdown provides a decay heat value of 24.6 MW or 83,935,200 BTU/hr. This total heat load value is assumed to be released in its entirety to the containment atmosphere where the spray removes the heat from the atmosphere and delivers it to the containment sump. In the sump, two RSS trains or four recirculation spray heat exchangers divide the total heat load evenly among themselves. This equates to a minimum required heat load of 41,967,600 BTU/hr per recirculation spray heat exchanger train (2 heat exchangers per train, one or both may be operating). This heat load value is conservative because the full amount will not escape the RCS, nor will it be completely captured by the spray. This value is approximately double of what would actually be present at the 67 hour time frame where throttling of the RSS heat exchanger River Water/Service Water is expected to occur (21,325,000 BTU/hr per train or 10,662,500 BTU/hr per heat exchanger).

The recirculation spray heat exchangers for both units are assumed to be plugged to their maximum allowable levels given in design inputs 5 and 6. Unit 1 has a 56 tube-plugging limit and Unit 2 has a 60 tube-plugging limit as provided by these design inputs. It is recognized that separate tube plugging levels exist for the individual heat exchangers at each unit. For example, the 1RS-E-1A and C possess 850 tubes and have a cumulative 56 tube-plugging limit for each train (28 tubes plugging limit per heat exchanger). It is considered conservative to use the smaller heat exchangers because the total heat

transfer surface area with maximum tubes plugged is smaller than the larger heat exchangers with their maximum tubes plugged. Also, both Unit 1 trains are assumed to have the smaller, 850-tube heat exchangers.

The sump temperatures for both units associated with long term cooling and sump recirculation are given in design inputs 11 and 12. The sump temperatures chosen are the long term constant temperatures present at approximately 3 hours for Unit 1 and 6 hours for Unit 2 after spray initiation. It is assumed that this temperature is present for long term sump recirculation which will be occurring when the river level reaches the extreme low level of 650' because the temperature will decrease over time with decay heat.

The nominal test curves for the river water/service water pumps are used for the flow throttle analysis. These are obtained from design inputs 7 through 10. It is recognized that when this test data is retaken, this calculation may be impacted if the pump curve degrades. The purpose of using the test curves for the pumps is to ensure the model reflects the most current as built information available for the plant in order to ensure that pressure-flow indication specified in the conclusions of this calculation are accurate.

Acceptance Criteria

The acceptance criteria of this calculation are that the total flow out of any single river intake bay does not exceed 7500 gpm and the recirculation spray heat exchangers maintain their design function by removing adequate heat from the containment sump.

8.0 Body of Analysis

The purpose of this calculation is to determine the throttled flow value for the recirculation spray heat exchangers with regard to bay limitations due to extreme low river conditions. Flomap input decks are created for both units using the dual train models developed in calculations 8700-DMC-3136, Rev. 2, Add. 3, and 10080-N-785, Rev. 2, Add. 2, for Units 1 and 2 respectively. The minimum operating pump curve is replaced by a nominal pump curve derived from design inputs 7 through 10. The pump curves used are shown below.

Nominal Pump Curve for 1WR-P-1A from Design Input 7

Flow (gpm)	Head (feet)
0.00	195.8
8000	169.5
8763	164.5
9200	162.4

Nominal Pump Curve for 1WR-P-1B from Design Input 8

Flow (gpm)	Head (feet)
0.00	208.8
8000	165.5
8763	162.5
9200	158.4

Nominal Pump Curve for 2SWS-P21A from Design Input 9

Flow (gpm)	Head (feet)
0.00	316.3
4000	315.7
6000	297.0
8000	285.9
9000	280.3
10000	273.3
11000	262.4
12000	250.6
13000	247.4
14000	220.6
15500	194.0

Nominal Pump Curve for 2SWS-P21B from Design Input 10

Flow (gpm)	Head (feet)
0.00	316.3
4000	314.7
6000	282.0
8000	270.9
9000	266.3
10000	262.3
11000	254.4
12000	242.6
13000	228.4
14000	211.6
15500	185.0

The above data was input into Flomap with specified flows through the recirculation spray heat exchanger paths. Flomap calculated the total flow removed from the bay by each operating pump and determines a pump discharge pressure that can be used to verify this flow. It has been found that the Unit 1 recirculation spray heat exchangers, 1RS-E-1A/B/C/D need to be throttled to 6200 gpm per train to maintain the proper flow limits from the bays. Unit 2 recirculation spray heat exchangers, 2RSS-E21A/B/C/D will need to be throttled to a flow of 5400 gpm per train to maintain proper flow limits from the bay. The runs showing these results are attached to this calculation.

With discovery of the above-mentioned flow rates, the throttled flows need to be justified to ensure the recirculation spray heat exchangers can perform their design function at the reduced flows. STER, a shell and tube heat exchanger evaluation program was used to evaluate the decreased flow rates with design temperatures, maximum tube plugging limits and calculated containment sump conditions. The following evaluation takes into account the possibility of either 1 or 2 heat exchangers being put into service on each train.

For Unit 1, the following parameters are used in the STER run. River Water temperature is 90 F (reference 6), Containment Sump temperature is 141 F (design input 11), Recirculation Spray flow is

1,750,000 lb/hr (design input 3) and fouling resistance factors of 0.0003 for the tube side and 0.0002 1/BTU/hr-ft^2-F for the shell side are specified (design input 18).

For Unit 2, the following parameters are used in the STER run. Service Water temperature is 89 F (reference 6), Containment Sump temperature is 109.9 F (design input 12), Recirculation Spray flow is 1,750,000 lb/hr (design input 3) and a tube side fouling factor of 0.0003 (design input 3) and a shell side fouling factor of 0.0002 1/BTU/hr-ft^2-F is specified.

A resultant heat load is calculated and compared with the required heat load assumed in the Assumptions section of this calculation, 49,815,200 BTU/hr per recirculation spray heat exchanger train applicable to Unit 1 and 41,967,600 applicable to Unit 2. The heat load for two recirculation spray heat exchangers operating in the same train is half of this number, 24,907,600 BTU/hr for Unit 1 and 20,983,800 for Unit 2.

Finally, the 13% screen blockage factor shall be analyzed with respect to river elevation and solid blockage level in front of the travelling screens. The generic orifice equation utilized in the base calculation will be used to determine the relationship between head loss across the screen and the screen blockage factor. The orifice equation is as follows.

$Q = C * A * (2 * g * h)^{1/2}$

Where Q is the flow rate in ft^3/sec, C is the orifice coefficient given in the base calculation as 0.9,
A is the flow area consisting of Width * % actual flow area * % unblocked area * (h + HL),
Where h+HL is the total height from the top of the solid blockage to the river elevation in feet,
And h is the head loss across the screens in feet.

The base calculation for this addendum developed an excel spread sheet that calculated the h+HL, total height from the top of the solid blockage to the river elevation, for various levels of solid blockage and associated bay flows. However, the spread sheet from the base calculation assumes a 13% screen blockage factor, which means 13% of the flow area is blocked by debris from the river.

In order to justify the 13% screen blockage factor, a differential pressure value will be calculated based on the 13% blockage factor, maximum allowable solid blockage levels and extreme low river conditions. This will provide a guideline setpoint for operators to manually activate the screen wash pumps to clean the travelling water screens during the critical time of a dam failure when this factor is critical to the bay flow supply. Under normal and flooding river elevation conditions, the current differential pressure actuated screen wash pump activation setpoint is more than adequate to ensure the screen cleanliness levels are such that the pumps have adequate flow.

Solving the above equation for head loss, h, and including unit conversion factors, the following is obtained.

Head loss, h (ft) = $1 / (2*g) * (35.314 \text{ ft}^3/\text{m}^3 * Q / (264.17 \text{ gal/m}^3 * 60 \text{ sec/min} * C*A))^2$

The gravity constant g is equal to 32.2 ft/sec2
The flow rate Q is assumed to be 7500 gpm based on bay limitations and 22" solid blockage limit.
C is given from the base calculation as 0.9.
A is derived as described above with the following values as given by the base calculation.

Screen width is 14 feet, 61% of the total screen area is open for flow (not metal or other structure or filler), 87% of the screen is not blocked from river debris, and the screen height is based on the difference between 22" of solid blockage and the river elevation of 648.6', h+HL = 0.767 feet. The screen height is derived from the Excel spreadsheet created in the base calculation of this addendum.

Head loss = 1/64.4 ft/sec^2 * (0.0022 ft^3-min/gal-sec * 7500 gpm / (0.9 * 14 ft * 0.61 * 0.87 * 0.767 ft))^2

Head loss = 0.16 ft = 2 inches differential pressure

Analyzing similar conditions with a 16.4 inch solid blockage limit provides a differential pressure across the travelling screen of approximately 3 inches.

Results/Conclusions

The first portion of this calculation determined the throttled flow to the recirculation spray heat exchangers to ensure that river bay limits are met under extreme low river elevation conditions. The Unit 1 Recirculation Spray heat exchangers, 1RS-E-1A/B/C/D, need to be throttled to approximately 3100 gpm each (assuming all four are in operation), or 6200 per train (assuming one heat exchanger per train is operating) and the Unit 2 Recirculation Spray heat exchangers, 2RSS-E21A/B/C/D, need to be throttled to approximately 2700 gpm each (assuming all four are in operation) or 5400 gpm per train (assuming one heat exchanger per train is operating).

In order to verify that the heat exchangers are throttled to the appropriate flow rate, the following expected header pressures should be used as indication. The Unit 1 "A" pump discharge pressure should be verified at approximately 48 psig and the "B" pump discharge should be verified at approximately 50 psig (say 49 psig as a general guideline). This pressure check can be performed using pressure indicators PI-1RW-101A/B/C. The flow rate can also be verified through flow indicators FI-1RW-102A and B for the "A" and "B" trains, respectively. These flow indicators are located before the branch off to the individual recirculation spray heat exchangers and should be verified to have a reading of approximately 6200 gpm per train. It should be noted that the above pressures and flows are provided as guidance to ensure specific limits are not exceeded. They are not exact requirements in that margin exists on the positive and negative side of the specified values.

Unit 2 has the capability to read flow rates directly via a control-a-tron, therefore, this instrumentation should be used to verify that no more than 7500 gpm is being taken from an individual bay. Also, due to pump minimum flow requirements, it should be verified that enough flow is obtained from the bay via this method.

The throttled flows are verified in the STER attachments to this calculation as meeting their design criteria in being able to remove a specified heat load from the containment sump. As shown in the attachments, each Unit 1 recirculation spray heat exchanger will remove 50,748,090 BTU/hr from a required 24,907,600 BTU/hr with the specified conditions given above. Each Unit 2 recirculation spray heat exchanger will remove 20,779,750 BTU/hr compared to a 20,983,800 BTU/hr with the specified conditions given above. The large difference in the individual unit results are expected due to the large difference in sump conditions at the time of evaluation. A much larger temperature difference exists for the Unit 1 containment sump resulting in a much larger heat load removal. As seen above, the unit 1 heat exchangers are more than capable of removing the required amount, however, the Unit 2 results are less than the required heat load specified.

However, the Unit 2 heat exchanger throttle flow is considered acceptable for the following reasons. The heat load given is for 6 hours after spray initiation. This is approximately twice the heat load required to be removed when the actual throttling will take place, approximately 60 hours later. Also, the approximate heat load removed by the concrete and floor in containment is 6,660,000 BTU/hr after 6 hours. This is shown in design input 12.

The 7500 gpm bay flow limit is based on the minimum pump flow requirements for the Unit 2 service water pumps. As stated in the 2OM-30 precautions and limitations section, three minimum flow rates exist. The following is permitted: a continuous minimum flow of 9100 gpm, a flow rate of 7500 gpm for 4 months, or a flow rate of 3750 gpm for 4 hours. As seen above, the 7500 gpm bay limit is not an operability limit nor should it be viewed as such. It is meant to be treated as operator guidance to protect the pump while maintaining required flows to the service water loads. The river water system has no minimum pump flow limit specified, however, for conservatism, the limit shall be applied to both units.

The 7500 gpm also corresponds to the maximum flow entering an individual bay when an average build up of 22 inches of solid blockage is present at the travelling screen. If it is verified that less than 22 inches of solid blockage is present, additional flow will be available for pump suction.

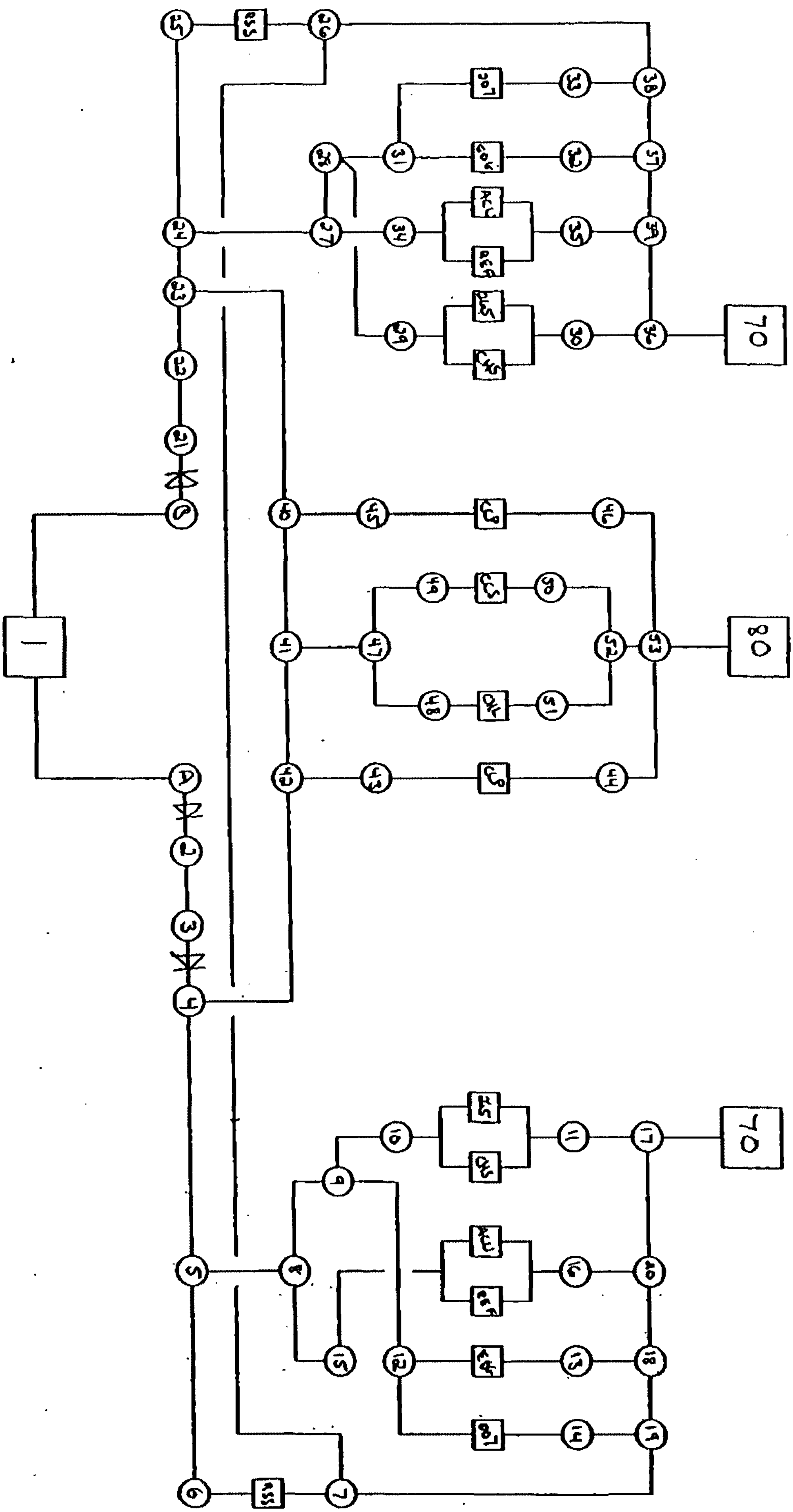
The current configuration for the travelling screens consists of the screen wash pump actuation and an alarm actuation when six inches of differential pressure is experienced across the travelling screens. At this setpoint, the screen wash pumps actuate, which clean the travelling screens and remove the debris from the screen. When the differential pressure reaches 2 inches across the screen, the screen cleaning system automatically shuts off and resets. It is suggested that, during extreme low river conditions, the differential pressure across the travelling screens should be monitored to ensure that the 13% blockage is not exceeded because this will impact the amount of flow permitted into the bay. If a differential pressure of 3 inches or more is present on LS-1CW-101A1 through D2, operators should manually start the screen wash system.

In conclusion, to maintain a bay limit of 7500 gpm under extreme low river elevation conditions coincident with a design basis accident, the recirculation spray heat exchanger trains should be throttled to 6200 gpm per heat exchanger at Unit 1 and 5400 gpm per heat exchanger at Unit 2. This will ensure that the pumps are protected from minimum flow limitation degradation and all the required service water/river water flows will be met.

~~10080-N-785, Rev 2, Add-1~~
~~page~~
~~Figure ONE~~

10080-N-779-1, Add. 1
Att. 1
Pg 1 of 2

UNIT 2
Flomap Nodal
Diagram



UNIT 1 ~~Fig 1 Add-1~~

Flomap Nodal Diagram.

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Add-1 Att.1

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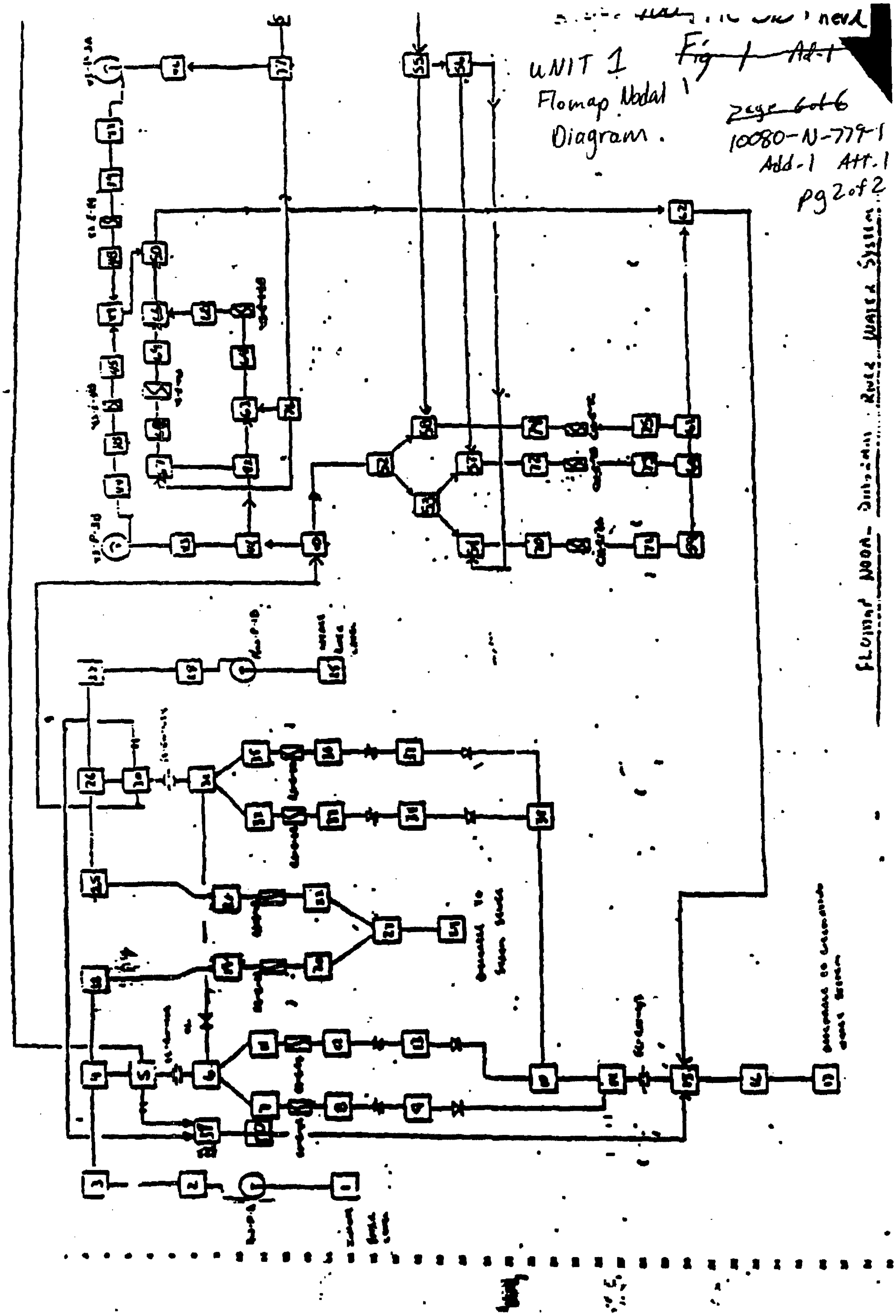

U1 OTR 9.doc 10080-N-779-1, Add.1 ATT. 2
Nominal Pump, 3100gpm/RSS Hx. Pg 1

FLOMAP-PC Revision 1.0
U-1 River Water System, New MOP for 1R14 Test Results, VS-E-14
dual train header Nominal pump with dam failure
Fluid: WATER Type of Calculation: Isothermal

Path	From Node	To Node	Resistance ft/gpm^2	Flowpath FL/D	Flowpath L/D	Pipe I.D. in	Pump Path	Valve Stat	Hx Path
1	1	2	.100000E-19	.00	.00	24.0000	Yes		
2	2	3	.842400E-07	.00	.00	24.0000			
3	3	4	.186100E-06	.00	.00	24.0000			
4	4	5	.503800E-07	.00	.00	24.0000			
5	5	6	.220260E-06	.00	.00	24.0000			
6	6	7	.360200E-06	.00	.00	24.0000			
7	7	8	.207800E-05	.00	.00	24.0000			
8	8	9	.100000E-19	.00	.00	24.0000			
9	9	14	.258140E-06	.00	.00	24.0000		Check	
10	10	14	.177700E-07	.00	.00	24.0000			
11	14	15	.149100E-06	.00	.00	24.0000			
12	15	16	.183800E-07	.00	.00	24.0000			
13	16	17	.100000E-19	.00	.00	24.0000			
14	6	11	.564500E-06	.00	.00	24.0000			
15	11	12	.176350E-05	.00	.00	24.0000			
16	12	13	.153220E-06	.00	.00	24.0000			
17	13	10	.197300E-06	.00	.00	24.0000		Check	
18	4	18	.296400E-04	.00	.00	24.0000			
19	18	19	.343000E-04	.00	.00	24.0000		Check	
20	19	20	.721150E-04	.00	.00	24.0000			
21	20	23	.117200E-04	.00	.00	24.0000			
22	18	21	1000.00	.00	.00	24.0000		Shut	
23	21	22	.629370E-04	.00	.00	24.0000			
24	22	23	.539600E-04	.00	.00	24.0000			
25	23	24	.128100E-04	.00	.00	24.0000			
26	29	28	.100000E-20	.00	.00	24.0000	Yes	Check	
27	28	27	.585000E-07	.00	.00	24.0000			
28	27	26	.161800E-06	.00	.00	24.0000			
29	26	30	.169200E-07	.00	.00	24.0000			
30	30	31	.154200E-06	.00	.00	24.0000			
31	31	32	.514100E-06	.00	.00	24.0000			
32	32	33	.171280E-05	.00	.00	24.0000			
33	33	34	.100000E-19	.00	.00	24.0000			
34	34	38	.257800E-06	.00	.00	24.0000		Check	
35	31	35	.515100E-06	.00	.00	24.0000			
36	35	36	.174510E-05	.00	.00	24.0000			
37	36	37	.100000E-19	.00	.00	24.0000			
38	37	38	.224500E-06	.00	.00	24.0000		Check	
39	38	10	.653500E-08	.00	.00	24.0000			
40	26	25	.296400E-04	.00	.00	24.0000			
41	25	19	1000.00	.00	.00	24.0000		Shut	
42	25	21	.296000E-04	.00	.00	24.0000			
43	31	6	.588500E-08	.00	.00	24.0000		Shut	
44	5	51	.180500E-04	.00	.00	24.0000			
45	40	41	.559400E-03	.00	.00	24.0000			
46	41	42	.778500E-04	.00	.00	24.0000			
47	42	67	.771200E-05	.00	.00	24.0000		Shut	
48	67	68	.423600E-04	.00	.00	24.0000			
49	68	69	.435610E-02	.00	.00	24.0000			
50	69	66	-.233320E-02	.00	.00	24.0000			
51	42	63	.574100E-04	.00	.00	24.0000			

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U-1 River Water System, New MOP for 1R14 Test Results, VS-E-14
dual train header Nominal pump with dam failure
Fluid: WATER Type of Calculation: Isothermal

Path	From Node	To Node	Resistance ft/gpm^2	Flowpath FL/D	Flowpath L/D	Pipe I.D. in	Pump Path	Valve Stat	Hx Path
52	63	64	.593700E-04	.00	.00	24.0000			
53	64	65	.168350E-02	.00	.00	24.0000			
54	65	66	.108700E-02	.00	.00	24.0000			
55	66	50	.481600E-05	.00	.00	24.0000			
56	50	62	.611300E-03	.00	.00	24.0000			
57	41	43	.322700E-03	.00	.00	24.0000		Shut	
58	43	44	.100000E-20	.00	.00	24.0000	Yes	Check	
59	44	78	.877000E-04	.00	.00	24.0000			
60	78	45	.220000E-03	.00	.00	24.0000			
61	45	49	.194700E-03	.00	.00	24.0000			
62	49	50	.518600E-04	.00	.00	24.0000			
63	40	52	.181700E-03	.00	.00	24.0000		Check	
64	52	53	.483400E-04	.00	.00	24.0000			
65	53	54	.145300E-02	.00	.00	24.0000			
66	54	70	.147700E-02	.00	.00	24.0000			
67	70	71	.122150	.00	.00	24.0000			
68	71	59	.410840E-01	.00	.00	24.0000			
69	59	60	.751500E-03	.00	.00	24.0000			
70	53	57	.399800E-03	.00	.00	24.0000		Check	
71	57	72	.193800E-02	.00	.00	24.0000		Shut	
72	72	73	.925740E-01	.00	.00	24.0000			
73	73	60	.531170E-01	.00	.00	24.0000			
74	60	61	.451500E-03	.00	.00	24.0000			
75	52	58	.399800E-03	.00	.00	24.0000		Shut	
76	58	74	.191300E-02	.00	.00	24.0000			
77	74	75	.149580	.00	.00	24.0000			
78	75	61	.795600E-02	.00	.00	24.0000			
79	61	62	.303900E-03	.00	.00	24.0000			
80	30	40	.125200E-04	.00	.00	24.0000			
81	51	77	.648300E-03	.00	.00	24.0000			
82	77	46	.215000E-03	.00	.00	24.0000		Shut	
83	46	47	.100000E-20	.00	.00	24.0000	Yes	Check	
84	47	79	.934900E-04	.00	.00	24.0000			
85	79	48	.533270E-02	.00	.00	24.0000			
86	48	49	.513800E-04	.00	.00	24.0000			
87	51	55	.146200E-03	.00	.00	24.0000		Check	
88	55	58	.649000E-03	.00	.00	24.0000			
89	55	56	.487000E-04	.00	.00	24.0000			
90	56	57	.649000E-03	.00	.00	24.0000			
91	56	54	.764200E-03	.00	.00	24.0000			
92	30	39	.596300E-07	.00	.00	24.0000		Shut	
93	5	39	.407300E-07	.00	.00	24.0000		Shut	
94	39	80	.686700E-06	.00	.00	24.0000			
95	62	15	.199700E-04	.00	.00	24.0000			
96	77	76	.798600E-04	.00	.00	24.0000			
97	76	67	.268200E-04	.00	.00	24.0000			
98	76	63	.761300E-04	.00	.00	24.0000		Shut	
99	80	15	.337800E-07	.00	.00	24.0000			

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Head/flow points for pump in Path 1 from node 1 to node 2.

Flow gpm	Head feet
.0000	195.8
8000.	169.5
8763.	164.5
9200.	162.4

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Head/flow points for pump in Path 26 from node 29 to node 28.

Flow gpm	Head feet
.0000	208.8
8000.	165.5
8763.	162.5
9200.	158.4

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Head/flow points for pump in Path 58 from node 43 to node 44.

Flow gpm	Head feet
.0000	55.00
120.0	54.00
140.0	53.00
160.0	52.00
180.0	50.00
200.0	49.00
230.0	45.00
263.0	40.00

Pump is not running.

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Head/flow points for pump in Path 83 from node 46 to node 47.

Flow gpm	Head feet
.0000	55.00
120.0	54.00
140.0	53.00
160.0	52.00
180.0	50.00
200.0	49.00
230.0	45.00
263.0	40.00

Pump is not running.

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Boundary Nodes--Input Temperature and Pressure

Node Number	Pressure psig	Temperature F
1	.0000	90.00
17	.0000	90.00
24	.0000	90.00
29	.0000	90.00

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Paths with Specified Flows

From Node	To Node	Flow gpm
7	8	3100.0
11	12	3100.0
32	33	3100.0
35	36	3100.0

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U-1 River Water System, New MOP for 1R14 Test Results, VS-E-14
dual train header Nominal pump with dam failure

path	from node	to node	hydraulic resistance (ft/gpm^2)	flowrate (gal/min)	pump head (ft)	heat transfer (btu/lb)	density (#/ft^3)	viscosity (cp)
1	1	2	.10000E-19	6962.1	172.9	.00	62.06	.78
2	2	3	.84240E-07	6962.1	.0	.00	62.06	.78
3	3	4	.18610E-06	6962.1	.0	.00	62.06	.78
4	4	5	.50380E-07	6329.1	.0	.00	62.06	.78
5	5	6	.22026E-06	6200.0	.0	.00	62.06	.78
6	6	7	.36020E-06	3100.0	.0	.00	62.06	.78
7	7	8	.53341E-05	3100.0	.0	.00	62.06	.78
8	8	9	.10000E-19	3100.0	.0	.00	62.06	.78
9	9	14	.25814E-06	3100.0	.0	.00	62.06	.78
10	10	14	.17770E-07	9300.0	.0	.00	62.06	.78
11	14	15	.14910E-06	12400.0	.0	.00	62.06	.78
12	15	16	.18380E-07	12700.5	.0	.00	62.06	.78
13	16	17	.10000E-19	12700.5	.0	.00	62.06	.78
14	6	11	.56450E-06	3100.0	.0	.00	62.06	.78
15	11	12	.48775E-05	3100.0	.0	.00	62.06	.78
16	12	13	.15322E-06	3100.0	.0	.00	62.06	.78
17	13	10	.19730E-06	3100.0	.0	.00	62.06	.78
18	4	18	.29640E-04	633.0	.0	.00	62.06	.78
19	18	19	.34300E-04	633.0	.0	.00	62.06	.78
20	19	20	.72115E-04	633.0	.0	.00	62.06	.78
21	20	23	.11720E-04	633.0	.0	.00	62.06	.78
22	18	21	.10000E+04	.0	.0	.00	62.06	.78
23	21	22	.62937E-04	607.9	.0	.00	62.06	.78
24	22	23	.53960E-04	607.9	.0	.00	62.06	.78
25	23	24	.12810E-04	1240.9	.0	.00	62.06	.78
26	29	28	.10000E-20	6979.4	171.0	.00	62.06	.78
27	28	27	.58500E-07	6979.4	.0	.00	62.06	.78
28	27	26	.16180E-06	6979.4	.0	.00	62.06	.78
29	26	30	.16920E-07	6371.4	.0	.00	62.06	.78
30	30	31	.15420E-06	6200.0	.0	.00	62.06	.78
31	31	32	.51410E-06	3100.0	.0	.00	62.06	.78
32	32	33	.60096E-05	3100.0	.0	.00	62.06	.78
33	33	34	.10000E-19	3100.0	.0	.00	62.06	.78
34	34	38	.25780E-06	3100.0	.0	.00	62.06	.78
35	31	35	.51510E-06	3100.0	.0	.00	62.06	.78
36	35	36	.60419E-05	3100.0	.0	.00	62.06	.78
37	36	37	.10000E-19	3100.0	.0	.00	62.06	.78
38	37	38	.22450E-06	3100.0	.0	.00	62.06	.78
39	38	10	.65350E-08	6200.0	.0	.00	62.06	.78
40	26	25	.29640E-04	607.9	.0	.00	62.06	.78
41	25	19	.10000E+04	.0	.0	.00	62.06	.78
42	25	21	.29600E-04	607.9	.0	.00	62.06	.78
43	31	6	.58850E-08	.0	.0	.00	62.06	.78
44	5	51	.18050E-04	129.1	.0	.00	62.06	.78
45	40	41	.55940E-03	124.0	.0	.00	62.06	.78
46	41	42	.77850E-04	124.0	.0	.00	62.06	.78

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U-1 River Water System, New MOP for 1R14 Test Results, VS-E-14
dual train header Nominal pump with dam failure

path	from node	to node	hydraulic resistance (ft/gpm^2)	flowrate (gal/min)	pump head (ft)	heat transfer (btu/lb)	density (#/ft^3)	viscosity (cp)
47	42	67	.77120E-05	.0	.0	.00	62.06	.78
48	67	68	.42360E-04	129.1	.0	.00	62.06	.78
49	68	69	.43561E-02	129.1	.0	.00	62.06	.78
50	69	66	-.23332E-02	129.1	.0	.00	62.06	.78
51	42	63	.57410E-04	124.0	.0	.00	62.06	.78
52	63	64	.59370E-04	124.0	.0	.00	62.06	.78
53	64	65	.16835E-02	124.0	.0	.00	62.06	.78
54	65	66	.10870E-02	124.0	.0	.00	62.06	.78
55	66	50	.48160E-05	253.1	.0	.00	62.06	.78
56	50	62	.61130E-03	253.1	.0	.00	62.06	.78
57	41	43	.32270E-03	.0	.0	.00	62.06	.78
58	43	44	.10000E-20	.0	.0	.00	62.06	.78
59	44	78	.87700E-04	.0	.0	.00	62.06	.78
60	78	45	.22000E-03	.0	.0	.00	62.06	.78
61	45	49	.19470E-03	.0	.0	.00	62.06	.78
62	49	50	.51860E-04	.0	.0	.00	62.06	.78
63	40	52	.18170E-03	47.4	.0	.00	62.06	.78
64	52	53	.48340E-04	47.4	.0	.00	62.06	.78
65	53	54	.14530E-02	21.8	.0	.00	62.06	.78
66	54	70	.14770E-02	23.5	.0	.00	62.06	.78
67	70	71	.12215E+00	23.5	.0	.00	62.06	.78
68	71	59	.41084E-01	23.5	.0	.00	62.06	.78
69	59	60	.75150E-03	23.5	.0	.00	62.06	.78
70	53	57	.39980E-03	25.6	.0	.00	62.06	.78
71	57	72	.19380E-02	.0	.0	.00	62.06	.78
72	72	73	.92574E-01	.0	.0	.00	62.06	.78
73	73	60	.53117E-01	.0	.0	.00	62.06	.78
74	60	61	.45150E-03	23.5	.0	.00	62.06	.78
75	52	58	.39980E-03	.0	.0	.00	62.06	.78
76	58	74	.19130E-02	23.9	.0	.00	62.06	.78
77	74	75	.14958E+00	23.9	.0	.00	62.06	.78
78	75	61	.79560E-02	23.9	.0	.00	62.06	.78
79	61	62	.30390E-03	47.4	.0	.00	62.06	.78
80	30	40	.12520E-04	171.4	.0	.00	62.06	.78
81	51	77	.64830E-03	129.1	.0	.00	62.06	.78
82	77	46	.21500E-03	.0	.0	.00	62.06	.78
83	46	47	.10000E-20	.0	.0	.00	62.06	.78
84	47	79	.93490E-04	.0	.0	.00	62.06	.78
85	79	48	.53327E-02	.0	.0	.00	62.06	.78
86	48	49	.51380E-04	.0	.0	.00	62.06	.78
87	51	55	.14620E-03	.0	.0	.00	62.06	.78
88	55	58	.64900E-03	23.9	.0	.00	62.06	.78
89	55	56	.48700E-04	-23.9	.0	.00	62.06	.78
90	56	57	.64900E-03	-25.6	.0	.00	62.06	.78
91	56	54	.76420E-03	1.7	.0	.00	62.06	.78
92	30	39	.59630E-07	.0	.0	.00	62.06	.78

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U-1 River Water System, New MOP for 1R14 Test Results, VS-E-14
dual train header Nominal pump with dam failure

path	from node	to node	hydraulic resistance (ft/gpm^2)	flowrate (gal/min)	pump head (ft)	heat transfer (btu/lb)	density (#/ft^3)	viscosity (cp)
93	5	39	.40730E-07	.0	.0	.00	62.06	.78
94	39	80	.68670E-06	.0	.0	.00	62.06	.78
95	62	15	.19970E-04	300.5	.0	.00	62.06	.78
96	77	76	.79860E-04	129.1	.0	.00	62.06	.78
97	76	67	.26820E-04	129.1	.0	.00	62.06	.78
98	76	63	.76130E-04	.0	.0	.00	62.06	.78
99	80	15	.33780E-07	.0	.0	.00	62.06	.78

DP of Flow cntl valve in Path 7 from node 7 to node 8: 22.1 psi.
DP of Flow cntl valve in Path 15 from node 11 to node 12: 20.2 psi.
DP of Flow cntl valve in Path 32 from node 32 to node 33: 24.9 psi.
DP of Flow cntl valve in Path 36 from node 35 to node 36: 25.0 psi.
Check valve in Path 87 from node 51 to node 55 shut.
Convergence Criterion = .1000E-01 gpm

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U-1 River Water System, New MOP for 1R14 Test Results, VS-E-14
dual train header Nominal pump with dam failure

node	Boundary node	elevation (feet)	pressure (psig)	temperature (Deg F)	fluid phase	external flow (+)in ; (-)out (lbm/sec)
1	yes	648.60	.00	90.00	liquid	.00
2	no	709.50	48.28	90.00	liquid	.00
3	no	709.50	46.52	90.00	liquid	.00
4	no	724.00	36.38	90.00	liquid	.00
5	no	724.00	35.51	90.00	liquid	.00
6	no	724.50	31.65	90.00	liquid	.00
7	no	699.00	41.14	90.00	liquid	.00
8	no	738.83	1.88	90.00	liquid	.00
9	no	738.83	1.88	90.00	liquid	.00
10	no	738.83	1.48	90.00	liquid	.00
11	no	699.00	40.30	90.00	liquid	.00
12	no	738.83	2.93	90.00	liquid	.00
13	no	738.83	2.29	90.00	liquid	.00
14	no	738.83	.81	90.00	liquid	.00
15	no	728.25	-4.51	90.00	liquid	.00
16	no	728.25	-5.78	90.00	liquid	.00
17	yes	714.83	.00	90.00	liquid	.00
18	no	726.25	30.29	90.00	liquid	.00
19	no	737.80	19.39	90.00	liquid	.00
20	no	737.80	6.94	90.00	liquid	.00
21	no	737.80	23.53	90.00	liquid	.00
22	no	737.80	13.51	90.00	liquid	.00
23	no	739.00	4.39	90.00	liquid	.00
24	yes	729.47	.00	90.00	liquid	.00
25	no	726.25	33.23	90.00	liquid	.00
26	no	724.00	38.92	90.00	liquid	.00
27	no	709.50	48.56	90.00	liquid	.00
28	no	709.50	49.79	90.00	liquid	.00
29	yes	654.00	.00	90.00	liquid	.00
30	no	724.00	38.62	90.00	liquid	.00
31	no	724.50	35.85	90.00	liquid	.00
32	no	699.00	44.71	90.00	liquid	.00
33	no	738.83	2.65	90.00	liquid	.00
34	no	738.83	2.65	90.00	liquid	.00
35	no	699.00	44.71	90.00	liquid	.00
36	no	738.83	2.52	90.00	liquid	.00
37	no	738.83	2.52	90.00	liquid	.00
38	no	738.83	1.59	90.00	liquid	.00
39	no	735.00	-7.42	90.00	liquid	.00
40	no	730.10	35.83	90.00	liquid	.00
41	no	722.50	35.40	90.00	liquid	.00
42	no	721.17	35.46	90.00	liquid	.00
43	no	720.25	16.60	90.00	liquid	.00
44	no	720.25	16.60	90.00	liquid	.00
45	no	719.25	17.03	90.00	liquid	.00
46	no	718.46	17.37	90.00	liquid	.00

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FLOMAP-PC Revision 1.0

U-1 River Water System, New MOP for 1R14 Test Results, VS-E-14
dual train header Nominal pump with dam failure

node	Boundary node	elevation (feet)	pressure (psig)	temperature (Deg F)	fluid phase	external flow (+)in ; (-)out (lbm/sec)
47	no	720.25	16.60	90.00	liquid	.00
48	no	719.25	17.03	90.00	liquid	.00
49	no	722.48	15.64	90.00	liquid	.00
50	no	722.50	15.63	90.00	liquid	.00
51	no	729.20	33.14	90.00	liquid	.00
52	no	732.96	34.42	90.00	liquid	.00
53	no	732.96	34.38	90.00	liquid	.00
54	no	727.00	36.65	90.00	liquid	.00
55	no	732.28	34.36	90.00	liquid	.00
56	no	732.28	34.37	90.00	liquid	.00
57	no	727.00	36.83	90.00	liquid	.00
58	no	727.00	36.48	90.00	liquid	.00
59	no	732.28	-4.88	90.00	liquid	.00
60	no	732.28	-5.06	90.00	liquid	.00
61	no	732.20	-5.14	90.00	liquid	.00
62	no	729.33	-4.20	90.00	liquid	.00
63	no	722.50	34.51	90.00	liquid	.00
64	no	720.45	35.00	90.00	liquid	.00
65	no	725.04	21.87	90.00	liquid	.00
66	no	722.50	15.76	90.00	liquid	.00
67	no	721.17	31.18	90.00	liquid	.00
68	no	720.78	31.04	90.00	liquid	.00
69	no	722.50	-1.01	90.00	liquid	.00
70	no	724.22	37.49	90.00	liquid	.00
71	no	724.40	8.31	90.00	liquid	.00
72	no	724.23	-1.59	90.00	liquid	.00
73	no	724.44	-1.68	90.00	liquid	.00
74	no	724.17	37.22	90.00	liquid	.00
75	no	724.44	.17	90.00	liquid	.00
76	no	721.17	31.37	90.00	liquid	.00
77	no	722.50	31.37	90.00	liquid	.00
78	no	718.48	17.36	90.00	liquid	.00
79	no	718.46	17.37	90.00	liquid	.00
80	no	740.00	-9.57	90.00	liquid	.00

U2THR3.doc

10080-N-779-1, Add.1, Att.3

Pg 1

2700gpm RSS ... Nominal Pump Curve from 2OST 30.2 & 30.3

FLOMAP-PC Revision 1.0

BVPS-2 Service Water 2 Train Model, R09 Full Flow Test Resistances

RSS Hxer throttled to 2700, bay flow limit of 7500, Nom. pump curve

Fluid: WATER Type of Calculation: Isothermal

Path	From Node	To Node	Resistance ft/gpm^2	Flowpath FL/D	Flowpath L/D	Pipe I.D. in	Pump Path	Valve Stat	Hx Path
1	1	2	.100000E-11	.00	.00	30.0000	Yes	Check	
2	1	21	.000000	.00	.00	30.0000	Yes	Check	
3	2	3	.697700E-07	.00	.00	30.0000			
4	3	4	.000000	.00	.00	30.0000			
5	4	5	.000000	.00	.00	30.0000			
6	5	6	.990160E-07	.00	.00	30.0000		Check	
7	5	8	.145360E-05	.00	.00	30.0000			
8	8	9	.842310E-05	.00	.00	30.0000			
9	9	10	.373130E-02	.00	.00	30.0000			
10	9	12	.772410E-05	.00	.00	30.0000			
11	8	15	.000000	.00	.00	30.0000			
12	7	19	.972485E-07	.00	.00	30.0000			
13	19	18	.388541E-07	.00	.00	30.0000			
14	18	20	.200770E-06	.00	.00	30.0000			
15	20	17	.515883E-07	.00	.00	30.0000			
16	17	70	.620539E-06	.00	.00	30.0000			
17	11	17	.000000	.00	.00	30.0000		Check	
18	13	18	.000000	.00	.00	30.0000		Check	
19	14	19	.000000	.00	.00	30.0000		Check	
20	16	20	.000000	.00	.00	30.0000		Check	
21	21	22	.697700E-07	.00	.00	30.0000			
22	22	23	.000000	.00	.00	30.0000			
23	23	24	.325000E-07	.00	.00	30.0000			
24	24	25	.990160E-07	.00	.00	30.0000		Check	
25	24	27	.145359E-05	.00	.00	30.0000			
26	27	28	.842310E-05	.00	.00	30.0000			
27	28	29	.373130E-02	.00	.00	30.0000			
28	28	31	.772410E-05	.00	.00	30.0000			
29	27	34	.000000	.00	.00	30.0000			
30	26	38	.972490E-07	.00	.00	30.0000			
31	30	36	.000000	.00	.00	30.0000		Check	
32	32	37	.000000	.00	.00	30.0000		Check	
33	33	38	.000000	.00	.00	30.0000		Check	
34	35	39	.000000	.00	.00	30.0000		Check	
35	36	70	.620540E-06	.00	.00	30.0000			
36	7	26	.000000	.00	.00	30.0000			
37	6	7	.263560E-06	.00	.00	30.0000			
38	25	26	.385270E-06	.00	.00	30.0000			
39	10	11	1.47450	.00	.00	30.0000			
40	29	30	.560650	.00	.00	30.0000			
41	10	11	.660640E-01	.00	.00	30.0000			
42	29	30	.113110	.00	.00	30.0000			
43	12	13	.714630E-04	.00	.00	30.0000			
44	31	32	.937100E-04	.00	.00	30.0000			
45	12	14	.933281E-03	.00	.00	30.0000			
46	31	33	.122790E-02	.00	.00	30.0000			
47	15	16	.166850E-02	.00	.00	30.0000			
48	34	35	.186670E-02	.00	.00	30.0000			
49	43	44	.000000	.00	.00	30.0000			
50	45	46	.100000E-11	.00	.00	30.0000			
51	49	50	.000000	.00	.00	30.0000			

FLOMAP-PC Revision 1.0

BVPS-2 Service Water 2 Train Model, R09 Full Flow Test Resistances
RSS Hxer throttled to 2700, bay flow limit of 7500, Nom. pump curve
Fluid: WATER Type of Calculation: Isothermal

Path	From Node	To Node	Resistance ft/gpm^2	Flowpath FL/D	Flowpath L/D	Pipe I.D. in	Pump Path	Valve Stat	Hx Path
52	48	51	.000000	.00	.00	30.0000			
53	4	42	.100000E-11	.00	.00	30.0000		Shut	
54	42	43	.100000E-11	.00	.00	30.0000			
55	44	53	.000000	.00	.00	30.0000			
56	42	41	.100000E-11	.00	.00	30.0000			
57	41	47	.100000E-11	.00	.00	30.0000			
58	47	48	.100000E-11	.00	.00	30.0000			
59	47	49	.100000E-11	.00	.00	30.0000			
60	51	52	.000000	.00	.00	30.0000			
61	50	52	.000000	.00	.00	30.0000			
62	52	53	.100000E-11	.00	.00	30.0000			
63	23	40	.000000	.00	.00	30.0000		Shut	
64	40	41	.100000E-11	.00	.00	30.0000			
65	40	45	.100000E-11	.00	.00	30.0000			
66	46	53	.000000	.00	.00	30.0000			
67	53	80	.100000E-11	.00	.00	30.0000		Check	
68	38	37	.388541E-07	.00	.00	30.0000			
69	37	39	.200770E-06	.00	.00	30.0000			
70	39	36	.515883E-07	.00	.00	30.0000			
71	44	17	.100000E-11	.00	.00	30.0000		Shut	
72	1	21	.100000E-11	.00	.00	30.0000	Yes	Check	

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Pg 3

FLOMAP-PC Revision 1.0
Head/flow points for pump in Path 1 from node 1 to node 2.

Flow gpm	Head feet
.0000	316.3
4000.	315.7
6000.	297.0
8000.	285.9
9000.	280.3
.1000E+05	273.3
.1100E+05	262.4
.1200E+05	250.6
.1300E+05	247.4
.1400E+05	220.6
.1550E+05	194.0

FLOMAP-PC Revision 1.0
Head/flow points for pump in Path 2 from node 1 to node 21.

Flow gpm	Head feet
.0000	350.3
4000.	265.7
6000.	249.0
8000.	240.9
9000.	236.3
.1000E+05	227.3
.1100E+05	219.4
.1200E+05	207.6
.1300E+05	195.4
.1400E+05	180.6
.1550E+05	146.0

Pump is not running.

FLOMAP-PC Revision 1.0

Head/flow points for pump in Path 72 from node 1 to node 21.

Flow gpm	Head feet
.0000	350.3
4000.	314.7
6000.	282.0
8000.	270.9
9000.	266.3
.1000E+05	262.3
.1100E+05	254.4
.1200E+05	242.6
.1300E+05	228.4
.1400E+05	211.6
.1550E+05	185.0

FLOMAP-PC Revision 1.0

Boundary Nodes--Input Temperature and Pressure

Node Number	Pressure psig	Temperature F
1	.0000	89.00
70	.0000	89.00
80	.0000	89.00

FLOMAP-PC Revision 1.0

Paths with Specified Flows

From Node	To Node	Flow gpm
6	7	5400.0
25	26	5400.0

FLOMAP-PC Revision 1.0

BVPS-2 Service Water 2 Train Model, R09 Full Flow Test Resistances
RSS Hxer throttled to 2700, bay flow limit of 7500, Nom. pump curve

path	from node	to node	hydraulic resistance (ft/gpm^2)	flowrate (gal/min)	pump head (ft)	heat transfer (btu/lb)	density (#/ft^3)	viscosity (cp)
1	1	2	.10000E-11	7395.7	289.3	.00	62.07	.79
2	1	21	.00000E+00	.0	.0	.00	62.07	.79
3	2	3	.69770E-07	7345.8	.0	.00	62.07	.79
4	3	4	.00000E+00	7345.8	.0	.00	62.07	.79
5	4	5	.00000E+00	7345.8	.0	.00	62.07	.79
6	5	6	.99016E-07	5400.0	.0	.00	62.07	.79
7	5	8	.14536E-05	1945.8	.0	.00	62.07	.79
8	8	9	.84231E-05	1635.0	.0	.00	62.07	.79
9	9	10	.37313E-02	53.9	.0	.00	62.07	.79
10	9	12	.77241E-05	1581.2	.0	.00	62.07	.79
11	8	15	.00000E+00	310.8	.0	.00	62.07	.79
12	7	19	.97249E-07	5290.0	.0	.00	62.07	.79
13	19	18	.38854E-07	5631.2	.0	.00	62.07	.79
14	18	20	.20077E-06	6871.2	.0	.00	62.07	.79
15	20	17	.51588E-07	7182.0	.0	.00	62.07	.79
16	17	70	.62054E-06	7235.8	.0	.00	62.07	.79
17	11	17	.00000E+00	53.9	.0	.00	62.07	.79
18	13	18	.00000E+00	1240.0	.0	.00	62.07	.79
19	14	19	.00000E+00	341.2	.0	.00	62.07	.79
20	16	20	.00000E+00	310.8	.0	.00	62.07	.79
21	21	22	.69770E-07	7093.0	.0	.00	62.07	.79
22	22	23	.00000E+00	7093.0	.0	.00	62.07	.79
23	23	24	.32500E-07	7093.0	.0	.00	62.07	.79
24	24	25	.99016E-07	5400.0	.0	.00	62.07	.79
25	24	27	.14536E-05	1693.0	.0	.00	62.07	.79
26	27	28	.84231E-05	1411.6	.0	.00	62.07	.79
27	28	29	.37313E-02	48.2	.0	.00	62.07	.79
28	28	31	.77241E-05	1363.4	.0	.00	62.07	.79
29	27	34	.00000E+00	281.4	.0	.00	62.07	.79
30	26	38	.97249E-07	5510.0	.0	.00	62.07	.79
31	30	36	.00000E+00	48.2	.0	.00	62.07	.79
32	32	37	.00000E+00	1069.7	.0	.00	62.07	.79
33	33	38	.00000E+00	293.7	.0	.00	62.07	.79
34	35	39	.00000E+00	281.4	.0	.00	62.07	.79
35	36	70	.62054E-06	7203.0	.0	.00	62.07	.79
36	7	26	.00000E+00	110.0	.0	.00	62.07	.79
37	6	7	.51567E-05	5400.0	.0	.00	62.07	.79
38	25	26	.46430E-05	5400.0	.0	.00	62.07	.79
39	10	11	.14745E+01	9.4	.0	.00	62.07	.79
40	29	30	.56065E+00	14.9	.0	.00	62.07	.79
41	10	11	.66064E-01	44.4	.0	.00	62.07	.79
42	29	30	.11311E+00	33.2	.0	.00	62.07	.79
43	12	13	.71463E-04	1240.0	.0	.00	62.07	.79
44	31	32	.93710E-04	1069.7	.0	.00	62.07	.79
45	12	14	.93328E-03	341.2	.0	.00	62.07	.79
46	31	33	.12279E-02	293.7	.0	.00	62.07	.79

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FLOMAP-PC Revision 1.0

BVPS-2 Service Water 2 Train Model, R09 Full Flow Test Resistances
RSS Hxer throttled to 2700, bay flow limit of 7500, Nom. pump curve

path	from node	to node	hydraulic resistance (ft/gpm^2)	flowrate (gal/min)	pump head (ft)	heat transfer (btu/lb)	density (#/ft^3)	viscosity (cp)
47	15	16	.16685E-02	310.8	.0	.00	62.07	.79
48	34	35	.18667E-02	281.4	.0	.00	62.07	.79
49	43	44	.00000E+00	.0	.0	.00	62.07	.79
50	45	46	.10000E-11	.0	.0	.00	62.07	.79
51	49	50	.00000E+00	.0	.0	.00	62.07	.79
52	48	51	.00000E+00	.0	.0	.00	62.07	.79
53	4	42	.10000E-11	.0	.0	.00	62.07	.79
54	42	43	.10000E-11	.0	.0	.00	62.07	.79
55	44	53	.00000E+00	.0	.0	.00	62.07	.79
56	42	41	.10000E-11	.0	.0	.00	62.07	.79
57	41	47	.10000E-11	-.0	.0	.00	62.07	.79
58	47	48	.10000E-11	.0	.0	.00	62.07	.79
59	47	49	.10000E-11	.0	.0	.00	62.07	.79
60	51	52	.00000E+00	.0	.0	.00	62.07	.79
61	50	52	.00000E+00	.0	.0	.00	62.07	.79
62	52	53	.10000E-11	-.0	.0	.00	62.07	.79
63	23	40	.00000E+00	.0	.0	.00	62.07	.79
64	40	41	.10000E-11	.0	.0	.00	62.07	.79
65	40	45	.10000E-11	.0	.0	.00	62.07	.79
66	46	53	.00000E+00	.0	.0	.00	62.07	.79
67	53	80	.10000E-11	.0	.0	.00	62.07	.79
68	38	37	.38854E-07	5803.7	.0	.00	62.07	.79
69	37	39	.20077E-06	6873.4	.0	.00	62.07	.79
70	39	36	.51588E-07	7154.8	.0	.00	62.07	.79
71	44	17	.10000E-11	.0	.0	.00	62.07	.79
72	1	21	.10000E-11	7143.4	275.7	.00	62.07	.79

Check valve in Path 2 from node 1 to node 21 shut.
DP of Flow cntl valve in Path 37 from node 6 to node 7: 64.8 psi.
DP of Flow cntl valve in Path 38 from node 25 to node 26: 58.4 psi.
Convergence Criterion = .1000E-01 gpm

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FLOMAP-PC Revision 1.0

BVPS-2 Service Water 2 Train Model, R09 Full Flow Test Resistances
RSS Hxer throttled to 2700, bay flow limit of 7500, Nom. pump curve

node	Boundary node	elevation (feet)	pressure (psig)	temperature (Deg F)	fluid phase	external flow (+)in ; (-)out (lbm/sec)
1	yes	648.60	.00	89.00	liquid	.00
2	no	709.00	98.65	89.00	liquid	-6.90
3	no	721.00	91.85	89.00	liquid	.00
4	no	723.00	90.99	89.00	liquid	.00
5	no	723.00	90.99	89.00	liquid	.00
6	no	726.50	88.23	89.00	liquid	.00
7	no	726.50	23.42	89.00	liquid	.00
8	no	723.00	88.62	89.00	liquid	.00
9	no	723.00	78.91	89.00	liquid	.00
10	no	726.50	72.74	89.00	liquid	.00
11	no	726.50	16.48	89.00	liquid	.00
12	no	726.50	69.08	89.00	liquid	.00
13	no	726.50	21.72	89.00	liquid	.00
14	no	726.50	22.25	89.00	liquid	.00
15	no	726.50	87.11	89.00	liquid	.00
16	no	726.50	17.63	89.00	liquid	.00
17	no	726.50	16.48	89.00	liquid	.00
18	no	726.50	21.72	89.00	liquid	.00
19	no	726.50	22.25	89.00	liquid	.00
20	no	726.50	17.63	89.00	liquid	.00
21	no	709.00	92.78	89.00	liquid	-6.96
22	no	721.00	86.10	89.00	liquid	.00
23	no	723.00	85.24	89.00	liquid	.00
24	no	723.00	84.53	89.00	liquid	.00
25	no	723.00	83.29	89.00	liquid	.00
26	no	726.50	23.42	89.00	liquid	.00
27	no	723.00	82.73	89.00	liquid	.00
28	no	723.00	75.50	89.00	liquid	.00
29	no	737.20	65.65	89.00	liquid	.00
30	no	737.30	11.70	89.00	liquid	.00
31	no	749.20	58.02	89.00	liquid	.00
32	no	735.80	17.57	89.00	liquid	.00
33	no	751.70	11.28	89.00	liquid	.00
34	no	737.10	76.66	89.00	liquid	.00
35	no	737.10	12.93	89.00	liquid	.00
36	no	726.50	16.36	89.00	liquid	.00
37	no	721.50	23.74	89.00	liquid	.00
38	no	726.50	22.15	89.00	liquid	.00
39	no	717.00	21.59	89.00	liquid	.00
40	no	723.00	2.59	89.00	liquid	.00
41	no	723.00	2.59	89.00	liquid	.00
42	no	723.00	2.59	89.00	liquid	.00
43	no	715.00	6.03	89.00	liquid	.00
44	no	719.00	4.31	89.00	liquid	.00
45	no	715.00	6.03	89.00	liquid	.00
46	no	719.00	4.31	89.00	liquid	.00

FLOMAP-PC Revision 1.0

BVPS-2 Service Water 2 Train Model, R09 Full Flow Test Resistances
RSS Hxer throttled to 2700, bay flow limit of 7500, Nom. pump curve

node	Boundary node	elevation (feet)	pressure (psig)	temperature (Deg F)	fluid phase	external flow (+)in ; (-)out (lbm/sec)
47	no	723.00	2.59	89.00	liquid	.00
48	no	738.20	-3.97	89.00	liquid	.00
49	no	757.00	-12.07	89.00	liquid	.00
50	no	757.00	-12.07	89.00	liquid	.00
51	no	738.20	-3.97	89.00	liquid	.00
52	no	726.60	1.03	89.00	liquid	.00
53	no	729.20	-.09	89.00	liquid	.00
70	yes	732.25	.00	89.00	liquid	.00
80	yes	729.00	.00	89.00	liquid	.00

10080-N-779-1 Add. 1 Att. 4
pg1

1RS-E-1A/B/C/D
56 tubes plugged
3100 gpm River water Flow

STER - 4.12

SHELL AND TUBE HEAT EXCHANGER RATING PROGRAM

This computer code is QA validated under Holtec International's QA program

Mode of Operation: PERFORMANCE PREDICTION
Name of Data File: S:RS-E-1A .PPS
File Description: recirc spray cooler

Component Identification: RS-E-1A
Component Description: unit 1 rs hx 1a and 1c
Method of calculation: DESIGN POINT

This report was created on: 10/23/2002 at 8:49:41.59

STER - 4.12 10/23/2002 at 8:49:41

Mode of Operation: PERFORMANCE PREDICTION
Name of Data File: S:RS-E-1A .PPS
File Description: recirc spray cooler

Component Identification: RS-E-1A
Component Description: unit 1 rs hx 1a and 1c
Method of calculation: DESIGN POINT

***** EQUIPMENT CONFIGURATION *****

PARAMETER	VALUE
Number of shells in series/parallel	1/ 1
Shell type	E
Number of tube passes	1
Number of tubes(holes in tubesheet)	850
Tube outside diameter, inches	.6250
Tube wall thickness, inches	.0350
Tube material: 304 STAINLESS STEEL	
Tube material thermal conductivity,Btu/hr/ft/	8.81
Tubeside inlet nozzle diameter, inches	14.00
Tubeside outlet nozzle diameter, inches	14.00
Effective H.T. surface area, ft^2	.0
Eff. Tube Length (ft.)	37.000

QA REFERENCES

********* DESIGN POINT **********

PARAMETER	TUBESIDE	SHELLSIDE
Temperature, deg F inlet/outlet	85.00 / 115.60	139.00 / 104.21
Flow rate, 1000 LB/HR	2000.00	1750.00
Pressure drop, psi	10.00	10.00
Fouling resistance, (1/Btu/Hr/ft^2/F)	.000300	.000200
Overall h.t. coefficient	564.00	
Shellside h.t. coeff. (finned tubes only)	.00	

QA REFERENCES

10080-N-779-1, Add. 1 Att. 4
pg3

STER - 4.12   10/23/2002 at 8:49:41

Mode of Operation: PERFORMANCE PREDICTION
Name of Data File: S:RS-E-1A .PPS
File Description: recirc spray cooler

Component Identification: RS-E-1A
Component   Description: unit 1 rs hx 1a and 1c
Method of calculation: DESIGN POINT

OUTPUT DATA

Procedure # 56 tube plgd   Date: 10/23/02

*** OFF DESIGN OUTPUT DATA ***

PARAMETER	TUBESIDE	SHELLSIDE
Fluid type	WATER	WATER
Temperature, deg F inlet/outlet	90.00 / 122.67*	141.00 / 112.07*
Flow rate, (1000 Lbm/hr)/(GPM)	1550.00 / 3120.72	1750.00 / 3515.50
Operating pressure, psig	50.00	114.70
Heat transfer coefficient, Btu/F/ft^2/hr	1357.49*	5270.49*
Pressure drop, psi	6.82*	10.00*
Fouling resistance, (1/Btu/Hr/ft^2/F)	.000300	.000200
Reynolds Number	34965.*	0.*

Heat Duty, Btu/hr-----------> 50748090.*
Overall h.t. coefficient----------->524.13*
Effective h.t. surface area per unit, ft^2--------> 4807.0*
LMTD----> 20.14*
Corrected LMTD----> 20.14*
Tubeside velocity, ft/sec---------> 5.2152*

	TUBESIDE	SHELLSIDE
Fluid property code	1	1
Reference temperatures, F	106.34	126.54
Density, lbm/ft^3	61.924	62.063
Specific Heat capacity, Btu/lbm F	.998	.999
Thermal conductivity, Btu/hr ft F	.3660	.3736
Absolute viscosity, cP	.636	.522

NOTE: Tubeside fouling refers to inside tube surface
Shellside fouling refers to outside tube surface
* - Indicates values calculated by STER.

10080-N-779-1 Add. 1 Att. 5
Pg1

2RSS-E21 A/B/C/D
60 Tubes Plugged
2700 gpm Service Water Flow

STER - 4.12

SHELL AND TUBE HEAT EXCHANGER RATING PROGRAM

This computer code is QA validated under Holtec International's QA program

Mode of Operation: PERFORMANCE PREDICTION
Name of Data File: S:UNIT2RSS.PPS
File Description: rss hx evaluation

Component Identification: UNIT2RSS.PPS
Component Description: unit 2 rss hx evaluation
Method of calculation: DESIGN POINT

This report was created on: 10/23/2002 at 12:30:59.83

STER - 4.12 10/23/2002 at 12:30:59

Mode of Operation: PERFORMANCE PREDICTION
Name of Data File: S:UNIT2RSS.PPS
File Description: rss hx evaluation

Component Identification: UNIT2RSS.PPS
Component Description: unit 2 rss hx evaluation
Method of calculation: DESIGN POINT

***** EQUIPMENT CONFIGURATION *****

PARAMETER	VALUE
Number of shells in series/parallel	1/ 1
Shell type	E
Number of tube passes	1
Number of tubes(holes in tubesheet)	1148
Tube outside diameter, inches	.6250
Tube wall thickness, inches	.0350
Tube material: 304 STAINLESS STEEL	
Tube material thermal conductivity,Btu/hr/ft/	8.75
Tubeside inlet nozzle diameter, inches	15.25
Tubeside outlet nozzle diameter, inches	13.25
Effective H.T. surface area, ft^2	.0
Eff. Tube Length (ft.)	37.270

QA REFERENCES

********* DESIGN POINT **********

PARAMETER	TUBESIDE	SHELLSIDE
Temperature, deg F inlet/outlet	89.00 / 99.70	111.45 / 94.30
Flow rate, 1000 LB/HR	2000.00	1750.00
Pressure drop, psi	10.00	10.00
Fouling resistance, (1/Btu/Hr/ft^2/F)	.000300	.000200
Overall h.t. coefficient	523.65	
Shellside h.t. coeff. (finned tubes only)	.00	

QA REFERENCES

STER - 4.12 10/23/2002 at 12:30:59

Mode of Operation: PERFORMANCE PREDICTION
Name of Data File: S:UNIT2RSS.PPS
File Description: rss hx evaluation

Component Identification: UNIT2RSS.PPS
Component Description: unit 2 rss hx evaluation
Method of calculation: DESIGN POINT

OUTPUT DATA

Procedure # rss 60 tb pg Date: 10/23/02

*** OFF DESIGN OUTPUT DATA ***

PARAMETER	TUBESIDE	SHELLSIDE
Fluid type	WATER	WATER
Temperature, deg F inlet/outlet	89.00 / 104.43*	109.90 / 98.00*
Flow rate, (1000 Lbm/hr)/(GPM)	1350.00 / 2712.56	1750.00 / 3515.50
Operating pressure, psig	50.00	50.00
Heat transfer coefficient, Btu/F/ft^2/hr	875.97*	********
Pressure drop, psi	5.04*	10.00*
Fouling resistance, (1/Btu/Hr/ft^2/F)	.000300	.000200
Reynolds Number	20042.*	0.*

Heat Duty, Btu/hr-----------> 20779750.*
Overall h.t. coefficient----------->441.86*
Effective h.t. surface area per unit, ft^2--------> 6634.9*
LMTD----> 7.09*
Corrected LMTD----> 7.09*
Tubeside velocity, ft/sec---------> 3.3082*

	TUBESIDE	SHELLSIDE
Fluid property code	1	1
Reference temperatures, F	96.72	103.95
Density, lbm/ft^3	62.049	62.063
Specific Heat capacity, Btu/lbm F	.998	.998
Thermal conductivity, Btu/hr ft F	.3621	.3650
Absolute viscosity, cP	.705	.652

NOTE: Tubeside fouling refers to inside tube surface
Shellside fouling refers to outside tube surface
* - Indicates values calculated by STER.

EL ==>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	TIME	PTOT	TEMP	TOF	TSR	HWOF	DQX	DQCSR	DQCXSR	DQSINK	DQSSP	DQDCY	DQSEN	NPSH	TDQSVW	DWCLT	DQCLT
	SEC	PSIG	DEGF	DEGF	DEGF	FT	MMBTU /HR	MMBTU /HR	MMBTU /HR	MMBTU /HR	MMBTU /HR	MMBTU /HR	MMBTU /HR	RSP/LH FT	BTU	LBM/SEC	BTU/SEC
	21210.00	-0.19	140.1	109.9	95.1	9.9	26.0	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.924E+08	2.1528E+01	2.4751E+04
	21220.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.926E+08	2.1527E+01	2.4750E+04
	21230.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.928E+08	2.1528E+01	2.4751E+04
	21240.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.930E+08	2.1524E+01	2.4746E+04
	21250.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.932E+08	2.1522E+01	2.4745E+04
	21260.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.934E+08	2.1522E+01	2.4745E+04
	21270.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.936E+08	2.1518E+01	2.4740E+04
	21280.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.939E+08	2.1517E+01	2.4738E+04
	21290.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.941E+08	2.1514E+01	2.4735E+04
	21300.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.943E+08	2.1514E+01	2.4735E+04
	21310.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.945E+08	2.1514E+01	2.4735E+04
	21320.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.947E+08	2.1506E+01	2.4726E+04
	21330.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.2	0.0	*******	5.949E+08	2.1508E+01	2.4728E+04
	21340.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.2	77.3	6.1	0.0	84.1	0.0	*******	5.951E+08	2.1508E+01	2.4728E+04
	21350.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.3	77.3	6.1	0.0	84.1	0.0	*******	5.954E+08	2.1502E+01	2.4721E+04
	21360.00	-0.19	140.1	109.9	95.1	9.9	26.1	51.3	77.3	6.1	0.0	84.1	0.0	*******	5.956E+08	2.1502E+01	2.4721E+04

LOCTIC Output for 10080-US(B)-223-1, Add. 2

10080-U-779-1, Add1 Att.6 P91

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  21370.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.1    0.0*******
5.958E+08 2.1499E+01 2.4718E+04
  21380.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.1    0.0*******
5.960E+08 2.1502E+01 2.4721E+04
  21390.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.1    0.0*******
5.962E+08 2.1492E+01 2.4709E+04
  21400.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.1    0.0*******
5.964E+08 2.1496E+01 2.4714E+04
  21410.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.1    0.0*******
5.966E+08 2.1493E+01 2.4711E+04
  21420.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.1    0.0*******
5.969E+08 2.1489E+01 2.4706E+04
  21430.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.1    0.0*******
5.971E+08 2.1490E+01 2.4708E+04
  21440.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.1    0.0*******
5.973E+08 2.1489E+01 2.4706E+04
  21450.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.1    0.0*******
5.975E+08 2.1486E+01 2.4702E+04
  21460.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.1    0.0*******
5.977E+08 2.1480E+01 2.4696E+04
  21470.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.0    0.0*******
5.979E+08 2.1481E+01 2.4697E+04
  21480.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.0    0.0*******
5.981E+08 2.1478E+01 2.4694E+04
  21490.00  -0.19  140.1  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.0    0.0*******
5.984E+08 2.1479E+01 2.4694E+04
  21500.00  -0.20  140.0  109.9   95.1   9.9   26.1   51.3   77.3    6.1    0.0   84.0    0.0*******
5.986E+08 2.1474E+01 2.4689E+04
  21510.00  -0.20  140.0  109.9   95.1   9.9   26.1   51.3   77.4    6.1    0.0   84.0    0.0*******
5.988E+08 2.1477E+01 2.4692E+04
  21520.00  -0.20  140.0  109.9   95.1   9.9   26.1   51.3   77.4    6.1    0.0   84.0    0.0*******
5.990E+08 2.1471E+01 2.4686E+04
  21530.00  -0.20  140.0  109.9   95.1   9.9   26.1   51.3   77.4    6.1    0.0   84.0    0.0*******
5.992E+08 2.1471E+01 2.4686E+04
  21540.00  -0.20  140.0  109.9   95.1   9.9   26.1   51.3   77.4    6.1    0.0   84.0    0.0*******
5.994E+08 2.1467E+01 2.4681E+04
  21550.00  -0.20  140.0  109.9   95.1   9.9   26.1   51.3   77.4    6.1    0.0   84.0    0.0*******
5.996E+08 2.1468E+01 2.4682E+04
  21560.00  -0.20  140.0  109.9   95.1   9.9   26.1   51.3   77.4    6.1    0.0   84.0    0.0*******
5.999E+08 2.1464E+01 2.4677E+04
  21570.00  -0.20  140.0  109.9   95.1   9.9   26.1   51.3   77.4    6.0    0.0   84.0    0.0*******
6.001E+08 2.1461E+01 2.4674E+04
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pg2

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   21580.00  -0.20  140.0  109.9    95.1    9.9    26.1    51.3    77.4     6.0     0.0   84.0     0.0*******
6.003E+08 2.1459E+01 2.4672E+04
   21590.00  -0.20  140.0  109.9    95.1    9.9    26.1    51.3    77.4     6.0     0.0   84.0     0.0*******
6.005E+08 2.1459E+01 2.4672E+04
   21600.00  -0.20  140.0  109.9    95.1    9.9    26.1    51.3    77.4     6.0     0.0   84.0     0.0*******
6.007E+08 2.1459E+01 2.4672E+04
   21630.00  -0.20  140.0  109.9    95.1    9.9    26.1    51.3    77.4     6.1     0.0   83.9     0.0*******
6.014E+08 2.1447E+01 2.4657E+04
   21660.00  -0.20  140.0  109.9    95.1    9.9    26.1    51.3    77.4     6.0     0.0   83.9     0.0*******
6.020E+08 2.1450E+01 2.4661E+04
   21690.00  -0.20  140.0  109.9    95.1    9.9    26.1    51.3    77.4     6.0     0.0   83.9     0.0*******
6.027E+08 2.1443E+01 2.4653E+04
   21720.00  -0.20  140.0  109.9    95.1    9.9    26.1    51.3    77.4     6.0     0.0   83.9     0.0*******
6.033E+08 2.1436E+01 2.4645E+04
   21750.00  -0.20  140.0  109.9    95.1    9.9    26.1    51.3    77.4     6.0     0.0   83.8     0.0*******
6.039E+08 2.1432E+01 2.4640E+04
   21780.00  -0.20  140.0  109.9    95.1    9.9    26.1    51.3    77.4     6.0     0.0   83.8     0.0*******
6.046E+08 2.1426E+01 2.4634E+04
   21810.00  -0.20  140.0  109.9    95.1    9.9    26.1    51.3    77.4     6.0     0.0   83.8     0.0*******
6.052E+08 2.1420E+01 2.4626E+04
   21840.00  -0.20  140.0  109.9    95.1    9.9    26.1    51.3    77.4     6.0     0.0   83.8     0.0*******
6.059E+08 2.1415E+01 2.4620E+04
   21870.00  -0.20  140.0  109.9    95.1    9.9    26.1    51.3    77.4     6.0     0.0   83.8     0.0*******
6.065E+08 2.1409E+01 2.4614E+04
   21900.00  -0.20  139.9  109.9    95.1    9.9    26.1    51.3    77.4     6.0     0.0   83.7     0.0*******
6.072E+08 2.1403E+01 2.4607E+04
1R0619F14  BV-2 PSDER W/EDG SEQUENCER FAILURE CASE:DLC.LOCTIC.DATA(BAS2RMAX)                 LOCTIC 17 JAN
2002 17:17:17    PAGE 167
 S & W ENGR CORP  NU-100     << CONTAINMENT ANALYSIS PROGRAM >>            LOCTIC.VER23.LEV03  CREATED
00.028  16:31:44    UNIT   9

 EL ==> 1      18      19      20      21      22      23      24      25      26      30      31      32      33
34     35     36     37
      TIME   DQAREC  DQATF  ALFAC  DWSPIL   TSPIL    TS  TLINER7  DQCLR   TX     NPSH    NPSH    NPSH    NPSH
VAP.PR  PTOT  VAP.PR VAP.PR
       SEC   MMBTU  MMBTU  BTU/HR- LBM/SEC    F       F       F   MMBTU     F   RSP-A1 RSP-A2 RSP-B1 RSP-B2
RSP/LH  PSIA  RSP-A1 RSP-A2
              /HR    /HR   FT2-F                                   /HR            FT      FT      FT      FT
PSIA           PSIA   PSIA

   21210.00     0.0   75.0    9.99   896.4   94.4   89.0  136.9    0.0   89.0**************    0.0
0.0*******   14.2**************
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pg 3

```
         T I M E =   21600.00 SEC ( 0 DAYS   6 HRS   0 MINS   0.0 SECS)        T E M P =    140.02 F
SATURATED
 DQAEC 1=      139.54 TDQAEC 1=    668162.44 DQAIR  =       -45.79 TDQAIR  =    -26881.02 DWCLT  =
214.59 TDWCLT  =   1145401.00
 DQAEC 2=     1331.92 TDQAEC 2=   6340862.00 DQAREC =          0.0 TDQARC  =          0.0 DWCS   =
0.0  TDWCS   =   1546744.00
 DQAEC 3=     1192.63 TDQAEC 3=   9864360.00 DQATF  =    207739.56 TDQATF  = 819870464.   DWCSR  =
9178.75 TDWCSR  =  18010560.0
 DQAEC 4=     4383.14 TDQAEC 4=  17107968.0  DQBOIL =          0.0 TDQBOL  =          0.0 DWGA   =
0.0  TDWGA   =    187297.81
 DQAEC 5=     3410.85 TDQAEC 5=  13181178.0  DQCLR  =          0.0 TDQCLR  =          0.0 DWP    =
0.0  WPR     =          0.0
 DQAEC 6=     1823.07 TDQAEC 6=   7048435.00 DQCLT  =    246720.69 TDQCLT  =1109085950.   DWSI   =
0.0  TDWSI   =    270589.81
 DQAEC 7=     2412.00 TDQAEC 7=  17117504.0  DQCS   =          0.0 TDQCS   =  28461568.0 DWSIR  =
0.0  TDWSIR  =          0.0
 DQAEC 8=     1330.93 TDQAEC 8=   9154951.00 DQCSR  =    142473.06 TDQCSR  = 319769856.   DWSPIL =
8964.16 TWSPIL  =  19127968.0
 DQAEC 9=     1911.77 TDQAEC 9=  14128144.0  DQDCY  =    233200.00 TDQDCY  = 696331008.   DWSPY  =
0.0  TDWSPY  =   5235997.00
 DQAEC10=      170.75 TDQAEC10=   1795638.00 DQDMP  =          0.0 TDQDMP  =          0.0 DWZRH  =
0.0  TDWSTR  =   7053321.00
 DQAEC11=       -5.60 TDQAEC11=     76771.56 DQHHSI =          0.0 TDQHSI  =   1829173.00 CORET  =
0.0  TDWZRH  =          0.0
 DQAEC12=      -14.69 TDQAEC12=    215279.87 DQLHSI =          0.0 TDQLSI  =    620199.69 TCS    =
94.41 TUPC     =  23175504.0
 DQAEC13=       -6.47 TDQAEC13=    122284.94 DQOTHH =          0.0 TDQOTH  =          0.0 TINJC  =
94.41 TUPR     =          0.0
 DQAEC14=      -42.10 TDQAEC14=    608773.12 DQPWR  =          0.0 TDQPWR  =          0.0 TPC    =
210.14 TUSGR   =          0.0
 DQAEC15=     -261.97 TDQAEC15=   3597259.00 DQQUEN =          0.0 TDQQUN  =   3690373.00
PAGA    =       11.57
 DQAEC16=     -256.88 TDQAEC16=   4062044.00 DQREC  =          0.0 TDQREC  =          0.0
PPR     =        0.0
 DQAEC17=      -31.06 TDQAEC17=    613039.87 DQRMSI =          0.0 TDQRSI  =          0.0 TS     =
89.00 PSG      =          0.0
 DQAEC18=     -171.87 TDQAEC18=   2127595.00 DQRV   =          0.0 TDQRV   =          0.0 TSG    =
0.0  PTOT    =        14.16
 DQAEC19=     -515.02 TDQAEC19=   5428567.00 DQSEN  =          0.0 TDQSEN  =          0.0 TSI    =
0.0  HIA     =  15296089.0
 DQAEC20=      -21.88 TDQAEC20=   2755368.00 DQSI   =          0.0 TDQSI   =   6699803.00 TSPIL  =
94.41
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pg 4

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 DQCOND =        0.0  TDQCND   =          0.0  DQSIR   =         0.0  TDQSIR   =          0.0  TSPY    =
0.0  HOF      = 583459584.
 DWCOND =        0.0  TDWCND   =          0.0  DQSPIL =   559446.69  TQSPIL  =1235515140.   TSR     =
95.13 WH2O    =   7501283.00
 DQCT   =   18347.50 TDQCT    =   84432656.0  DQSSP   =         0.0  TDQSSP   =          0.0
WIA     =    13070.51
 DQCTF  =     157.79 TDQCTF   =   1787820.00 ADQSSP =         0.0  TADQSP   =          0.0  TTOT    =
0.0
 DQST   =   -1739.19 TDQST    =   29767616.0  DQSTG   =         0.0  TDQSTG   =          0.0
WLEFT   =        0.0
 DQSTF  =      12.96 TDQSTF   =      7228.24 DQWP    =         0.0  TDQWP    =          0.0  TX      =
89.00 WOF     =   7488213.00
                                               DQX     =    72449.25 TDQX     = 280946688.   TXA     =
0.0  WRIT     =           0.0
 ALFAC  =       9.97 TCND     =       140.02 FF      =         0.0  HEITZ    =          0.0  TXI     =
99.36 WCLT    =   130090.00
 DZ     =      10.00 RVP      =        14.16 DQZRW   =         0.0  TDQZRW   =          0.0  TXS     =
94.27 WTOT    =         0.0
 SEQTBL =    1800.00 SEQTIL   =      1800.00 SUMBL   =         0.0  SUMIL    =          0.0
DELINJ  =        0.0
                      DQNRE    =          0.0  DWNRE   =         0.0
 DROP   =        0.0  QDROP    =          0.0  DWOF    =      215.29 TDWOF    =   1137280.00 TPR     =
0.0  WCI      =           0.0
 TDQPMP = -127368.69 TDQSIO   =1457371140.    DQWOF   =    23256.51 TDQWOF   = 165431840.   TQDROP =
0.0
 TDWT2  =        0.0  TANKA1   =          0.0  TANKA2 =         0.0  TANKB1   =          0.0  TANKB2 =
0.0  DQXA1    =     72449.25
 DQXA2  =        0.0  DQXB1    =          0.0  DQXB2   =         0.0  TRPA1    =       109.93 TRPA2   =
0.0  TRPB1    =           0.0
 TRPB2  =        0.0  TSRA1    =        95.13 TSRA2   =         0.0  TSRB1    =          0.0  TSRB2   =
0.0  TXSA1    =          99.54
 TXSA2  =      89.00 TXSB1    =          0.0  TXSB2   =         0.0
1R0619F14  BV-2 PSDER W/EDG SEQUENCER FAILURE CASE:DLC.LOCTIC.DATA(BAS2RMAX)                 LOCTIC 17 JAN
2002 17:17:17    PAGE 145
 S & W ENGR CORP  NU-100     << CONTAINMENT ANALYSIS PROGRAM >>                LOCTIC.VER23.LEV03  CREATED
00.028  16:31:44    UNIT   6

0    TIME      TEMP      P TOT     P AIR     P STM     FREE HEAT     LIQ TEMP     ATM
     SECS        F       PSIG      PSIA      PSIA       MM BTU          F        STATE

  21210.00   140.12     -0.19     11.27      2.90      598.599       109.9    SATURATED
  21220.00   140.12     -0.19     11.27      2.90      598.604       109.9    SATURATED
```

10080-N-779-1, Add. 1, Att. 6
Pg 5

RTL# A1.002D

Calculation Affected Document Review Checklist

Calculation: 10080-N-779 Revision: 1 Addendum: 1

		YES	NO	DOCUMENT/SECTION
	Do the Calculation Assumptions and/or Conclusions affect:			
1.	The UFSAR?	☐	☒	
2.	Technical Specifications?	☐	☒	
3.	Design Basis Documents?	☐	☒	
4.	The Operating Manual?*	☒	☐	1/2OM-30
5.	The Abnormal Operating Procedures?*	☒	☐	Extreme high & Low river AOPs
6.	Emergency Procedures?*	☐	☒	
7.	OST/BVT Procedures?*	☒	☐	Bay cleaning, others as appropriate
8.	The ISI/IST Program?*	☐	☒	
9.	Other Plant Procedures?*	☐	☒	
10.	Equipment Setpoints?*	☐	☒	
11.	Other BVPS Calculations?	☐	☒	
12.	Vendor Calculations?	☐	☒	
13	Other VTIs?*	☐	☒	
14.	Equipment Specifications?	☐	☒	
15.	Procurement Specifications?	☐	☒	
16.	The Fire Protection Safe Shutdown Report?	☐	☒	
17.	The EQ Program?	☐	☒	
18.	Any other Design Basis documents?	☐	☒	
19.	Any radiological inputs and/or consequences?	☐	☒	

* When these items are checked YES, list the Engineering Change Package number that will update or track the update of the affected document(s). Attach this Checklist to the Calculation to document this review.

ECP 02-0721 Rev. 1

FirstEnergy

DESIGN VERIFICATION RECORD

NOP-CC-2001-01 Rev. 00

SECTION I: TO BE COMPLETED BY DESIGN ORIGINATOR

DOCUMENT(S)/ACTIVITY TO BE VERIFIED:

10080-N-779, Rev. 1, Add. 1

☒ SAFETY RELATED ☐ AUGMENTED QUALITY ☐ NONSAFETY RELATED

SUPPORTING/REFERENCE DOCUMENTS

DESIGN ORIGINATOR: *(Print and Sign Name)*	DATE
DT Bloom [signature]	

SECTION II: TO BE COMPLETED BY VERIFIER

VERIFICATION METHOD *(Check one)*

☑ DESIGN REVIEW *(Complete Design Review Checklist or Calculation Review Checklist)* ☐ ALTERNATE CALCULATION ☐ QUALIFICATION TESTING

JUSTIFICATION FOR SUPERVISOR PERFORMING VERIFICATION:

APPROVAL: *(Print and Sign Name)*	DATE

EXTENT OF VERIFICATION:

COMMENTS, ERRORS OR DEFICIENCIES IDENTIFIED? ☐ YES ☐ NO

RESOLUTION: *(For Alternate Calculation or Qualification Testing only)*

RESOLVED BY: *(Print and Sign Name)*	DATE
VERIFIER: *(Print and Sign Name)* K. TROXLER [signature]	DATE 10/17/02
APPROVED BY: *(Print and Sign Name)* EJ Fredrick [signature]	DATE 10/29/02

FirstEnergy	# CALCULATION REVIEW CHECKLIST NOP-CC-2001-04 Rev. 00	 CALCULATION NO. N-779 REV. 1, Add-1 UNIT 1 & 2

QUESTION	NA	Yes	No	COMMENTS	RESOLUTION
REFERENCES					
1 Does the stated objective/purpose clearly describe why the calculation is being performed?		✓			
2. Are applicable codes, standards, design/licensing basis documents, etc., including edition and addenda where appropriate clearly identified?		✓			
3. Do the references reflect the appropriate revision?.		✓			
INPUTS					
4. Are design inputs clearly identified and their source documents referenced, including revision level as appropriate?		✓			
5. Are the design inputs relevant, current, consistent with design/licensing bases and directly applicable to the purpose of the calculation, including appropriate tolerances and ranges/modes of operation?		✓			
6. Are all design inputs retrievable? If not, have they been added as attachments?		✓			
7. Are preliminary or conceptual inputs clearly identified for later confirmation as open assumptions?	✓				
ASSUMPTIONS					
8. Have the assumptions necessary to perform the analysis been adequately documented?		✓			
9. Is suitable justification provided for all assumptions (except those based upon recognized engineering practice, physical constants or elementary scientific principles)?		✓			
10. Are all assumptions for the calculation reasonable and consistent with design/licensing bases?		✓			
11. Have all open assumptions needing later confirmation been clearly identified on the Calculation cover sheet, including when the open assumption needs to be closed?	✓				
12. Has a Condition Report been issued for open assumptions if required?	✓				
13. Have engineering judgments been used?		✓			
14. Are engineering judgments reasonable and adequately documented?		✓			
METHOD OF ANALYSIS					
15. Is the method used appropriate considering the purpose and type of calculation?		✓			
16. Is the method in accordance with applicable codes, standards, and design/licensing bases?		✓			
IDENTIFICATION OF COMPUTER CODES (Ref: NOP-SS-1001)					
17. Have the versions of the computer codes employed in the design analysis been certified for this application?	✓	✓		STER HAS BEEN CERTIFIED	
18. Are codes properly identified along with source, inputs and outputs?		✓			
19. Is the code suitable for the analysis being performed?		✓			
20. Does the computer model, that has been created, adequately reflect actual (or to be modified) plant conditions (e.g., dimensional accuracy, type of model/code options used, time steps, etc.)?		✓			
21. Is the computer output reasonable when compared to inputs and what was expected?				SEE PAGE 2	
COMPUTATIONS					
22. Are the equations used consistent with recognized engineering practice and design/licensing bases?		✓			
23. Is justification provided for any equations not in common use?	✓				
24. Is the justification reasonable?	✓				
25. Have adjustment factors, uncertainties, empirical correlations, etc., used in the analysis been correctly applied?		✓			
26. Is the result presented with proper units and tolerance?		✓			
27. Has proper consideration been given to results that may be overly sensitive to very small changes in input?		✓			

FirstEnergy

CALCULATION REVIEW CHECKLIST

NOP-CC-2001-04 Rev. 00

CALCULATION NO. N-779
REV. 1, Ad-1
UNIT 1 & 2

QUESTION	NA	Yes	No	COMMENTS	RESOLUTION
CONCLUSIONS					
28. Is the magnitude of the result reasonable when compared to inputs?		✓			
29. Is the direction of trends reasonable?	✓				
30. Are stated conclusions justifiable based on the calculation results?		✓			
31. Are all pages sequentially numbered and marked with a valid calculation number?		✓			
32. Is all information legible and reproducible?		✓			
33. Have all changes in the documentation been initialed (or signed) and dated by the author of the change and all required reviewers?		✓			
34. Have all calculation results stayed within existing design/licensing basis parameters?		✓			
35. If the response to Question 34 is NO, has Licensing been notified as appropriate? (i.e. UFSAR or Tech Spec Change Request has been initiated).	✓				
36. Does the calculation meet its purpose/objective?		✓			
37. Has the calculation vendor used all applicable design information/requirements provided?	✓				
38. Did the calculation vendor determine if the calculation was referenced in design basis documents and/or databases?	✓				
39. Did the Preparer determine if the calculation was used as a reference in the UFSAR?	✓				
40. If the calculation is used as a reference in the UFSAR, is a change to the UFSAR required or an update to the UFSAR Validation Database, if applicable, required?	✓				
41. If the answer to Question 40 is YES, have the appropriate documents been initiated?	✓				
42. Is the calculation acceptable for use?		✓			
43. What checking method was used to review the calculation? Check all that apply.					
• spot check for math		✓			
• complete check for math					
• comparison with tests					
• check by alternate method		✓			
• comparison with previous calculation		✓			

Review Summary:

☐ **Technical Review**		☐ **Owner's Acceptance Review** *(Required for calculations prepared by a vendor)*	
Reviewer *(Print and Sign Name)* K. TROXLER K Troxler	Date 10/17/02	Reviewer: *(Print and Sign Name)*	Date
		Approver: *(Print and Sign Name)*	Date

21 - ATTACHMENT 5 STEP RUN WAS CHECKED BY A MANUAL CALCULATION WHICH WAS FOUND TO AGREE WITHIN 3%.

ONE PATH THRU THE FLOWMAP MODEL IN ATTACHMENT 2 WAS CHECKED MANUALLY AND WAS FOUND TO AGREE WITHIN 4%.

FirstEnergy	CALCULATION ADDENDUM		
	NOP-CC-3002-02 Rev. 02		
INITIATING DOCUMENT(S) ECP 04-0447	CALCULATION NO. 10080-N-779	CALCULATION REV. 1	ADDENDUM NO. 2
TITLE/SUBJECT: (MUST MATCH ORIGINAL CALCULATION TITLE (SUBJECT) BVPS Unit 1 and Unit 2 Response to a Dam Failure			

☒ BV1	☒ BV2	☐ DB	☐ PY
Classification	☐ Tier 1 Calculation	☒ Safety-Related/Augmented Quality	☐ Nonsafety-Related
Open Assumptions?	☐ Yes ☒ No	If Yes, Enter CR Tracking Number	N/A

Computer Program(S)

Program Name	Version / Revision	Category	Status	Description
None	N/A	N/A	N/A	N/A

ORIGINATOR/DATE 6-6-05	REVIEWER/DESIGN VERIFIER/DATE 6/20/05	APPROVER/DATE 6/20/05
Douglas T. Bloom [signature]	Gary V. Cacciani G.V. Cacciani	Colin P. Keller C.P. Keller

OBJECTIVE OR PURPOSE OF ADDENDUM:

The purpose of this calculation addendum is to document voiding and superceding of various design inputs utilized in the base calculation of 10080-N-779, Rev. 1. This addendum will determine the impacts of each design input change and provide the new design input documents for the utilized values.

SCOPE OF ADDENDUM:

The following changes are evaluated within this Addendum:

1) Calculation 8700-DMC-2353, Rev. 1 has been superceded by calculation 8700-DMC-2353, Rev. 2. The allowable tube plugging levels for the Unit 1 Recirculation Spray Heat Exchangers [1RS-E-1A, C] changed from 56 tubes to 40 tubes. With respect to calculation 10080-N-779, it is more conservative to utilize the higher tube plugging value, because it lowers the heat removal capabilities of the Unit 1 Recirculation Spray Heat Exchangers. The 56-tube value will continue to be used for the purposes of calculation 10080-N-779. However, it is noted that the actual plugging limit is somewhat less.

2) Calculation 8700-DMC-2339, Rev. 2 has been superceded by calculation 8700-DMC-2353, Rev. 2 with respect to the Recirculation Spray (RS) heat exchanger UA values, which include fouling factors. The fouling factors for the RS heat exchangers have not changed with the design input, therefore, there are no impacts with respect to this aspect of 8700-DMC-2353, Rev. 0.

LIST NEW DOCUMENTS TO BE ADDED TO THE DOCUMENT INDEX (DIN):

The following changes shall be made to the document index:

1) Remove calculations 8700-DMC-2339, Rev. 2 and 8700-DMC-2353, Rev. 1 and replace them with 8700-DMC-2353, Rev. 2 (Design Input)

SUMMARY OF RESULTS/CONCLUSIONS OF ADDENDUM:

As shown above, the impacted design inputs from the superceded documents are not changed with respect to the new DINs. The conclusions of calculation 10080-N-779, Rev. 1, are unchanged with respect to the implementation of ECP 04-0447.

LIMITATIONS OR RESTRICTIONS CREATED BY ADDENDUM:

There are no limitations or restrictions associated with this addendum.

IMPACT OF ADDENDUM ON OUTPUT DOCUMENTS:

There is no impact to any other document as a result of this addendum.

FirstEnergy	CALCULATION ADDENDUM
	NOP-CC-3002-02 Rev. 02

INITIATING DOCUMENT(S)	CALCULATION NO.	CALCULATION REV.	ADDENDUM NO.
ECP 04-0447	10080-N-779	1	2

TITLE/SUBJECT: (MUST MATCH ORIGINAL CALCULATION TITLE (SUBJECT)

BVPS Unit 1 and Unit 2 Response to a Dam Failure

DESCRIBE WHERE THE ADDENDUM WILL BE EVALUATED FOR 10CFR50.59 APPLICABILITY:

For the evaluation of 10CFR50.59 applicability, see ECP 04-0447 (RAD and Screen 04-03629)

LIST SUPPORTING DOCUMENTS: (Include total number of pages)

The following supporting documents are associated with this calculation:

1) Design Verification Record — 1 Page

2) Calculation Review Checklist — 3 Pages

LIST ATTACHMENTS: (Include total number of pages)

No attachments are associated with this calculation addendum.

FirstEnergy

DESIGN VERIFICATION RECORD

NOP-CC-2001-01 Rev. 00

SECTION I: TO BE COMPLETED BY DESIGN ORIGINATOR

DOCUMENT(S)/ACTIVITY TO BE VERIFIED:

10080-N-779, Rev. 1, Add. 2

☒ SAFETY RELATED ☐ AUGMENTED QUALITY ☐ NONSAFETY RELATED

SUPPORTING/REFERENCE DOCUMENTS

8700-DMC-2363, Rev. 2	

DESIGN ORIGINATOR: *(Print and Sign Name)*	DATE
Douglas T Bloom [signature]	6-6-05

SECTION II: TO BE COMPLETED BY VERIFIER

VERIFICATION METHOD *(Check one)*

☑ DESIGN REVIEW *(Complete Design Review Checklist or Calculation Review Checklist)* ☐ ALTERNATE CALCULATION ☐ QUALIFICATION TESTING

JUSTIFICATION FOR SUPERVISOR PERFORMING VERIFICATION:

N/A - Supervisor did not perform

APPROVAL: *(Print and Sign Name)*	DATE

EXTENT OF VERIFICATION:

Reviewed stated input changes due to revision of references. As noted, they had no impact ~~of~~ GVC 6/20/05 on the parameter results of the base calculations.

COMMENTS, ERRORS OR DEFICIENCIES IDENTIFIED? ☐ YES ☑ NO

RESOLUTION: *(For Alternate Calculation or Qualification Testing only)*

N/A - No alternate calculation or testing.

RESOLVED BY: *(Print and Sign Name)*	DATE
VERIFIER: *(Print and Sign Name)*	DATE
G.V. Cacciani [signature]	6/20/05
APPROVED BY: *(Print and Sign Name)*	DATE
C.P. Keller [signature]	6/20/05

FirstEnergy	CALCULATION REVIEW CHECKLIST NOP-CC-2001-04 Rev. 03	CALCULATION NO. 10080-N-779 REV. 1 ADDENDUM NO. 2 UNIT 1/2

QUESTION	NA	Yes	No	COMMENTS	RESOLUTION
GENERAL					
1 Does the stated objective/purpose clearly describe why the calculation is being performed?		✓			
2. Are design input / output documents and references listed and clearly identified in the document index, including edition and addenda, where applicable?		✓			
3. Were verbal inputs from third parties properly documented?	✓			No such inputs.	
4. Are design input parameters, such as physical and geometric characteristic and regulatory or code and standard requirements, accurately taken from the design input documents and correctly incorporated, including tolerances and units?		✓			
5. Are the design inputs relevant, current, consistent with design/licensing bases and directly applicable to the purpose of the calculation, including appropriate tolerances and ranges/modes of operation?		✓			
6. Are all design inputs retrievable? If not, have they been added as attachments?		✓			
7. Are preliminary or conceptual inputs clearly identified for later confirmation as open assumptions?	✓			No such inputs	
8. Where applicable, were construction and operating considerations included as input information?	✓			"	
9. Were design input / output documents properly updated to reference this calculation?		✓			
ASSUMPTIONS					
10. Have the assumptions necessary to perform the analysis been clearly identified and adequately described?		✓		Old input for tube plugging bounds revised input	
11. Are all assumptions for the calculation reasonable and consistent with design/licensing bases?		✓		"	
12. Have all open assumptions needing later confirmation been clearly identified on the Calculation cover sheet, including when the open assumption needs to be closed?	✓			No open assumptions	
13. Has a Condition Report been issued for open assumptions?	✓			"	
14. Have engineering judgments been clearly identified?	✓			No judgements.	
15. Are engineering judgments reasonable and adequately documented?	✓			"	
16. Is suitable justification provided for all assumptions/engineering judgements (except those based upon recognized engineering practice, physical constants or elementary scientific principles)?	✓			"	
METHOD OF ANALYSIS					
17. Is the method used appropriate considering the purpose and type of calculation?		✓		Revised inputs.	
18. Is the method in accordance with applicable codes, standards, and design/licensing bases?	✓			Inputs have no affect on base analysis.	
IDENTIFICATION OF COMPUTER CODES (Ref: NOP-SS-1001)					
19. Have the versions of the computer codes employed in the design analysis been certified for this application?	✓			Not relevant to revision r	
~~20. Are codes properly identified along with source (vendor, organization, etc.)?~~	✓			"	
21. Is the code applicable for the analysis being performed?	✓			"	
22. Is the computer program(s) being used listed on the FENOC Usable Software List for the site?	✓			"	

FirstEnergy

CALCULATION REVIEW CHECKLIST

NOP-CC-2001-04 Rev. 03

CALCULATION NO. 10080-N-779
REV. 1
ADDENDUM NO. 2
UNIT 1/2

QUESTION	NA	Yes	No	COMMENTS	RESOLUTION
23. Does the computer model, that has been created, adequately reflect actual (or to be modified) plant conditions (e.g., dimensional accuracy, type of model/code options used, time steps, etc.)?	✓			Use of code not relevant to revision	
24. Did the computer output generate any ERROR or WARNING Messages that could invalidate the results?	✓			"	
25. Is the computer output reasonable when compared to inputs and what was expected?	✓			"	
COMPUTATIONS					
26. Are the equations used consistent with recognized engineering practice and design/licensing bases?	✓			Revision to inputs does not result in different calculations	
27. Is there a reasonable justification provided for the uses of any equations not in common use?	✓			"	
28. Were the mathematical operations performed properly and the results accurate?	✓			"	
29. Have adjustment factors, uncertainties, empirical correlations, etc., used in the analysis been correctly applied?	✓			"	
30. Is the result presented with proper units and tolerance?		✓		As presented	
31. Has proper consideration been given to results that may be overly sensitive to very small changes in input?	✓			As in 26-29.	
CONCLUSIONS					
32. Is the magnitude of the result reasonable and expected when compared to inputs?		✓			
33. Is there a reasonable justification provided for deviations from the acceptance criteria?	✓	✓		No such deviations	
34. Are stated conclusions justifiable based on the calculation results?		✓			
35. Are all pages sequentially numbered and marked with a valid calculation and revision number?		✓			
36. Is all information legible and reproducible?		✓			
37. Is the calculation presentation complete and understandable without any need to refer back to the Originator for clarification or explanations?		✓			
38. Is calculation format presented in a logical and orderly manner, in conformance with the standard calculation content of NOP-CC-3002 (Attachment 1)?		✓			
39. Have all changes in the documentation been initialed (or signed) and dated by the author of the change and all required reviewers?	✓			No such changes	
DESIGN/LICENSING					
40. Have all calculation results stayed within existing design/licensing basis parameters?		✓			
41. If the response to Question 40 is NO, has Licensing been notified as appropriate? (i.e. UFSAR or Tech Spec Change Request has been initiated).	✓			Response to 41 is "Yes"	
42. Is the direction of trends reasonable?		✓			
43. Has the calculation Preparer used all applicable design information/requirements provided?		✓			
44. Did the calculation Preparer determine if the calculation was referenced in design basis documents and/or databases?		✓			
45. Did the Preparer determine if the calculation was used as a reference in the UFSAR?		✓			
46. If the calculation is used as a reference in the UFSAR, is a change to the UFSAR required or an update to the UFSAR Validation Database, if applicable, required?	✓			No UFSAR impact	
47. If the answer to Question 46 is YES, have the appropriate documents been initiated?	✓			"	

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CALCULATION REVIEW CHECKLIST

NOP-CC-2001-04 Rev. 03

CALCULATION NO. 10080-N-779
REV. 1
ADDENDUM NO. 2
UNIT 1/2

QUESTION	NA	Yes	No	COMMENTS	RESOLUTION
48. Has the applicability of 10CFR50.59 to this calculation been considered and documented?		✓		ECP 09-0447 RAD 09-0329 is created	
ACCEPTABLE					
49. Does the calculation meet its purpose/objective?		✓			
50. Is the calculation acceptable for use?		✓			
51. What checking method was used to review the calculation? Check all that apply.					
• spot check for math	✓			Not relevant to changed input	
• complete check for math	✓				
• comparison with tests	✓				
• check by alternate method	✓				
• comparison with previous calculation		✓			

Review Summary: Input revision has no impact on previous calculation results - design basis is unchanged.

Technical Review *(Print and Sign Name)*	Date	Owner's Acceptance Review *(Required for calculations prepared by a vendor)*	
G.V. Cacciani / G.V. Cacciani	6/20/05	Reviewer *(Print and Sign Name)*	Date
Design Verification *(Print and Sign Name)* G.V. Cacciani / G.V. Cacciani	Date 6/20/05	Approver *(Print and Sign Name)*	Date

5. ERS-JTL-99-005, “Unit 1 Letdown Radiation Monitor (RM-CH-101) Alarm Setpoint Calculation and Emergency Action Level (EAL) Value Determination,” Revision 3

Beaver Valley Power Station

Radiation Protection Technical Position/Evaluation/Calculation

Subject	No.	PAGE 1 OF
Unit 1 Letdown Radiation Monitor (RM-1CH-101) Alarm Setpoint Calculation and Emergency Action Level (EAL) Value Determination	**ERS-JTL-99-005**	21

Reference

HPP____ EPP ____ T/S ____ CR ____ DCP____

Category

☐ Technical Position ☒ Technical Evaluation ☐ Calculation

Unit 1 ☒ Unit 2 ☐

Purpose

This technical evaluation documents determination of the High and High-High alarm setpoints for the Unit 1 letdown radiation monitor, including process safety limit and trip setpoint for the high range and low range channels (ref. CR 990281). Also, monitor response to RCS concentrations of 0.1 uCi/g, 0.35 uCi/g, 21 uCi/g and 300 uCi/g are calculated.

☐ **ORIGINAL ISSUE**

☒ **REVISION #** 3

Revision description:

Directly calculated the DE I-131 monitor response by using ratio technique applied to the 1% FF design equivalent concentration (3.69 uCi/g) and the corresponding calculated monitor value. Added the letdown radiation monitor indications that correspond to an RCS concentration equivalent to 21 uCi/g dose equivalent iodine-131 (DE I-131). This is done for both the 843-30 and 843-30R detector types. This value is proposed for use as part of the NEI EAL upgrade project for EAL SU9. Updated references. Corrected 843-30R low range channel I-131 detector efficiency.

by	checker/reviewer	independent review (calculation only)
John T. Lebda 8-9-11 date	Michael Unfried 8/9/11 date	N/A - Not a Calculation date

Checklist

☒ Purpose
☒ Methodology
☒ Input Data
☒ Results
☒ References

Attachments

☒ Data Sheets
☐ Illustrations
☐ Printouts
☐ Code Listings

☒ Transmittal to BVRC
☒ Original RP ERF FILE
☐ MGR, Radiation Protection
☐ Supt, Rad Ops
☐ Supv, RP Services
☐ Supv, Rad Waste/Effluents
☒ Author: John T. Lebda BV-ERF
☒ Hal Szklinski BV-SIM
☐ Michael Unfried SEB-3
☐ ____

PURPOSE

The purpose of this calculation is to determine the alarm setpoints (high-high and high) for the Unit 1 letdown radiation monitor, RM-1CH-101 high range and low range channels.

DISCUSSION

<u>REVISION HISTORY:</u>

Revision 0:

The previous calculation of record, SWEC RP-11700-87, Rev. 0[1], was reviewed during an investigation of an identified setpoint discrepancy (ref. CR 990281[2]). This review discovered that, for the high range channel, the contribution from iodine-135 to the monitor indication was miscalculated, and the necessary correction for fluid density change between the reactor coolant system (RCS) and the monitor sample line was not made. These errors resulted in an overly conservative setpoint. Using such a setpoint could lead to spurious alarms and may have contributed to the condition described in CR 990281. Revision 0 corrected these issues & used updated parameters in the calculation.

Revision 1:

This revision was made to calculate alarm setpoints that correspond to reactor coolant radioactivity concentrations of 0.1 and 0.35 dose equivalent I-131. In addition, monitor indication that corresponds to 300 uCi/g dose equivalent I-131 is provided. Revision 0 was unchanged and this additional information was provided in an Addendum.

Revision 2:

Made the same calculations as the previous revisions using efficiencies for the 843-30R detector type. The most recent RCS design/Technical Specification radioactivity concentrations are used in the calculations. The package text was updated.

Revision 3:

Directly calculated the DE I-131 monitor response by using ratio technique applied to the 1% FF design equivalent concentration (3.69 uCi/g) and the corresponding calculated monitor value. Added the letdown radiation monitor indications that correspond to an RCS concentration equivalent to 21 uCi/g dose equivalent iodine-131 (DE I-131). This is done for both the 843-30 and 843-30R detector types. This value is proposed for use as part of the NEI EAL upgrade project for EAL SU9. Updated references.

<u>ADDITIONAL DISCUSSION:</u>

The Unit 1 UFSAR[3] describes the licensing basis for the Unit 1 letdown process flow radiation monitor (CH-101):

"The gross activity of the reactor coolant is continuously monitored by two detectors. The samples are drawn from the reactor coolant letdown line and delayed to permit sufficient decay of N-16 isotope before they pass by the detectors. In this system, large variations in the activity are possible depending upon the amount of fission products leaked to the coolant. The alarm setpoints can be set to provide graded indications of reactor coolant activity increases. This system cam be flushed with clean water from a flush line inlet upstream of the sample monitor."

The USNRC SER[4] for Unit 1 states:

"The gross activity of the reactor coolant will be monitored by a low range and a high range detector located in the reactor coolant letdown line. We believe that this system is capable of detecting gross failed fuel and is acceptable."

CH-101 is an off-line monitor physically located near the northeast corner of the PAB elevation 722'. It draws sample flow from the letdown piping prior to the system demineralizers and degassifiers. The fluid at this point is cooled to approximately 90 °F. Additional cooling may be expected as the fluid passes thourgh the sample line to the monitor. The sample line is equipped with a temperature control valve that closes if the sample fluid temperature exceeds about 134±3 °F5. This calculation will use 137 °F as a conservative value.

The original monitor configuration included two shielded gamma scintillation detectors. Channel CH-101A was designated as the high range channel, and CH-101B, the low range channel. The detector/sample line geometry between the two channels was identical with the exception that a lead attenuator plug was placed between the high range detector and the sample line. This option was available for the low range channel should letdown fluid radioactivity be high and a redundant high range channel desired. However, in 1981 the channels were noted to read the same, and the alarm setpoints for the two channels were changed to be identical[6].

The basis for the alarm setpoints was established in the SWEC setpoint calculation as the RCS design maximum radioactivity concentrations which would result from operating with 1% failed fuel.

This is considered a reasonable value for "gross failed fuel", however, no specific commitment to this basis could be found. The basis for the Unit 2 letdown radiation monitor[7] is an RCS radioactivity concentration corresponding to the Technical Specification[8] radioactivity limit of 1 μCi/g dose equivalent iodine 131. This difference between the Units is thought to result from the difference in dates that the Units were licensed, and is not researched further here.

SWEC[19] also calculated high alarm setpoint values for the high range channel. The calculation used 0.25% failed fuel as the basis. This is the only place that any high setpoint basis is provided, and no justification is given. During the development of this calculation, Radiological Operations expressed concern that a high setpoint based on 0.25% failed fuel would be too close to the monitor background and requested that setpoint values be based on 0.5% failed fuel. REAP 1.105 recognizes such situations and (Step 5.3.2.3) permits an alternative approach. As such, the high setpoint calculated herein will be based on 0.5% failed fuel.

METHODOLOGY

The methodology used herein remains similar to that used in RP-11700-87-0. The RCS activity concentrations (μCi/g) assumed are those activities which result from operation with 1% failed fuel[9]. The list of isotopes used is identical to that in the original calculation of record with the exception of Mn-54, which was added in Revision 0 of this package. Mn-54, along with the other activation products which are included in this calculation, are present in such low concentrations that they have no influence on the monitor indication.

The activity concentrations (μCi/g) are converted to μCi/cc by applying an appropriate density correction. Because the concentrations are expressed in μCi/g, the only correction needed is to account for the density difference between the fluid in the sample line and the density at standard temperature and pressure. This correction is applied prior to multiplying the monitor efficiency to obtain the individual isotope count rate contribution. The individual contributions are then summed to determine the monitor process safety limit.

The activity concentrations used to calculate this first setpoint are based on a specific set of operating parameter values that influence the concentrations. These are related to processes that remove radioactivity from the RCS and are, letdown flow rate, letdown filtration and demineralization efficiencies and leakage from the RCS. The 1% failed fuel RCS concentration calculation maximizes the activity concentrations by selecting each parameter value, within the design operation range, such that radioactivity removal is minimized (ref. Unit 1 UFSAR Table 14B-5). Because actual operating conditions are different, and these differences will cause the 1% failed fuel RCS concentrations to be lower, adjustments are necessary to avoid using a non-conservatively high setpoint. The adjustment discussed above is made by assuming a typical letdown flow rate of 105 gpm[10]. All activity removed from the system by letdown is assumed not to be returned. This minimizes RCS radioactivity concentrations, and adds a small conservatism to the setpoint calculation. RCS leakage is typically very low, and even when maximized would be low as compared to the radioactivity removal by letdown. Therefore, the influence of RCS leakage is ignored in this calculation. To make the correction for increased letdown flow rate, an equilibrium radioactivity removal rate while operation at 60 gpm is calculated for each radionuclide by summing the radioactive decay removal rate constant with the letdown removal rate constant. This is applied to total RCS activity to obtain the net removal rate (μCi/s) from the system. At equilibrium, the removal rate is assumed to be equal to the release rate form the fuel. The sequence of this calculation is then reversed using 105 gpm in place of 60 gpm to obtain radioactivity concentrations (μCi/g) while operating at the higher flow rate. The setpoint calculation is then repeated to determine the process safety limit when operating with letdown at 105 gpm. The calculations described above are performed for both the high range and low range monitor configurations.

A second set of monitor indication values are provided which correspond to the design radioactivity mix reduced to concentrations equal to a dose equivalent iodine 131 of 0.1 μCi/g, 0.35 μCi/g, 21 uCi/g and 300 uCi/g. These calculations do not require any adjustments associated with changes in letdown flow rate as the measurements are direct (the radiation monitor responds to RCS radioactivity), rather than derived (percent failed fuel inferred by measuring RCS radioactivity). All are calculated by simple ratio technique applied to the 1% FF (3.69 uCi/g) monitor indication. Instrument error is not applied to these values herein. This should be done if these are later used as alarm setpoint values.

Determination of radiation monitor alarm setpoint uncertainty used herein is consistent with previous similar applications for both Unit 1 and Unit 2. Regulatory Guide 1.105[12] provides the basis for instrument setpoints for safety related systems. BVPS Unit 2 is committed to the Regulatory Guide, while Unit 1 is not. Historically established guidelines provide four conditions where it may be prudent to apply uncertainty analysis to a Unit 1 radiation monitor. These are, if the monitor or setpoint, 1) is QA Category 1, 2) initiates an automatic process control function, 3) is specifically referenced by an emergency operating procedure, or 4) initiates manual operator action that results in a change in the configuration of any safety related process systems.

CH-101 is referenced in several EOPs, and the High-High alarm is used to determine if fuel damage may have occurred which, in turn, may affect operator actions. Although other means for detecting failed fuel, such as chemistry sampling and monitoring or in-plant radiation levels are routinely employed, monitor uncertainty analysis is appropriate.

As with older monitors at Unit 1, many of the allowances which are considered in setpoint uncertainty analyses are not provided for the letdown radiation monitor. Historically established appropriate assumptions for some of these. Also, this defines the Total Loop Uncertainty as:

$$TLU = (EA^2 + PA^2 + CA^2 + SA^2 + DA^2 + LA^2 + TA)^{0.5}$$

and, the Trip Setpoint as:

$$TSP = AL / [1 + (\%{=}TLU) / 100 + (\%\text{-DEADBAND}) / 100]$$

Because many of TLU allowances are not available for the Unit 1 monitors, the uncertainty analyses for safety related monitors is assumed to be +100%, -50%. This leads to a value of 2.1 as the divisor for the Analytical Limit (or, Process Safety Limit). This high degree of conservatism is not necessary for the letdown radiation monitor. The assumptions used therein were reviewed against the available vendor documentation and are found to be reasonable and sufficiently conservative for the letdown radiation monitor. The errors and uncertainty allowances are:

Factory calibration allowance (CA_1) = 20%
Onsite calibration allowance (CA_2) = 10%
Sensor allowance for rate meter response (SA_1) = 5%
Sensor allowance for alarm circuitry (SA_2) = 2%
Process allowance (PA) = 0%
Leakage allowance (LA) = 0%
Environmental allowance (EA) = 0%
Administrative tolerance (TA) = 10%
Drift allowance (DA) = 10%
Deadband = 10%

$$TLU = (0.20^2 + 0.10^2 + 0.05^2 + 0.02^2 + 0.10^2 + 0.10^2)^{0.5} = 0.27 = 27\%$$

$$TSP = AL / [1 + (27 / 100) + (10 / 100)] = 1.37$$

See Attachment 1 for additional information concerning alarm setpoint determination methodology.

After the setpoints (Process Safety Limits) are calculated, each will be divided by 1.37 to obtain setpoints having uncertainty analysis applied.

INPUT DATA AND ASSUMPTIONS

1. 1% Failed Fuel RCS Radioactivity Concentrations (high-high setpoint) [9]
   (Refer to Attachment 1)
   0.5% Failed Fuel RCS Radioactivity Concentrations (high setpoint)
   (requested by Radiological Operations as discussed above)

2. Maximum Fluid Temperature at Monitor = 137 °F. [5]

3. Fluid Density at Monitor = 61.43 lbm/ft^3 [13]
   Fluid Density at ST = 62.43 lbm/ft^3

4. CH-101 Channel Efficiencies - 843-30 detector (See calculations) [14]

4. CH-101 Channel Efficiencies - 843-30R detector [Attachment 2]

5. Letdown volume Flow Rates = 60 gpm minimum [10,15,16]
   = 105 gpm normal

6. Letdown Mass Flow Rates (calculated):

$$\frac{60 \text{ gpm} * 3785.3 \text{ cc/gal} * 1 \text{ g/cc} * (61.43 \text{ lbm/ft}^3 / 62.43 \text{ lbm/ft}^3)}{60 \text{ s/min}} = 3.725\text{E}3 \text{ g/s}$$

$$\frac{105 \text{ gpm} * 3785.3 \text{ cc/gal} * 1 \text{ g/cc} * (61.43 \text{ lbm/ft}^3 / 62.43 \text{ lbm/ft}^3)}{60 \text{ s/min}} = 6.158\text{E}3 \text{ g/s}$$

7. RCS Mass = 1.8084E8 g [9]
   (Average of mass at 100% power, 0% and 22% S/G tubes plugged)

8. Radionuclide Half-Live Times = (Refer to Attachment 1) [18]

9. RCS Technical Specification and DE I-131 concentrations corresponding to 1% FF [9]

10. Radionuclide Decay Rate Constants

    Calculated: =ln(2) / Radionuclide Half-Live (s)

11. Letdown Flow Rate Removal Constants

    Calculated: = Letdown Mass Flow Rate (g.s) / RCS Mass (g)

12. All radioactivity removed by the letdown system is assumed not to be returned to the system. Returned activity is expected to be small, and this assumption is conservative for the setpoint calculation.

13. RCS leakage is ignored. Leakage is typically very low, and this influence is small as compared to the removal by letdown.

14. When the amount of RCS radioactivity is at equilibrium, the rate of radioactivity removal from the system is equal to the release rate from the fuel.

RESULTS

843-30 detector with updated source term:

1% FF Basis	60 gpm letdown operation (cpm)		105 gpm letdown operation (cpm)	
	High	High-High	High	High-High
CH-101 High Range Channel	3.72E+03	7.44E+03	3.03E+03	6.06E+03
CH-101 Low Range Channel	n/a	1.00E+06 (1.47E+6)	n/a	9.93E+05

843-30R detector with updated source term:

1% FF Basis	60 gpm letdown operation (cpm)		105 gpm letdown operation (cpm)	
	High	High-High	High	High-High
CH-101 High Range Channel	4.78E+03	9.57E+03	3.77E+03	7.54E+03
CH-101 Low Range Channel	n/a	1.00E+06 (2.67E+6)	n/a	1.00E+06 (1.70E+6)

SWEC provided a low range channel, high-high alarm setpoint with 0.05% failed fuel used as the basis. The basis is deemed acceptable and is applied to give the final setpoints (for the low range channel). Because the calculated low range channel setpoints are still above the monitor range, the highest on-scale value of 1.00E6 is provided with the calculated value shown in parenthesis. Consistent with previous calculations, no high setpoint is provided for the low range channel. All values are reduced for instrument error consideration.

RM-CH-101A/B Indication Corresponding to Various DE I-131 RCS Concentrations

Updated design source term basis with 843-30 detector:	Low Range Channel (cpm)	High Range Channel (cpm)
Page 9 monitor indication with 1% FF (3.69 uCi/g DE I-131) =	4.02E+07	1.02E+04
Monitor indication with 0.1 uCi/g DE I-131 =	1.09E+06	2.76E+02
Monitor indication with 0.35 uCi/g DE I-131 =	3.82E+06	9.66E+02
Monitor indication with 21 uCi/g DE I-131 =	2.29E+08	5.80E+04
Monitor indication with 300 uCi/g DE I-131 =	3.27E+09	8.28E+05
Updated design source term basis with 843-30R detector:		
Page 12 monitor indication with 1% FF (3.69 uCi/g DE I-131) =	7.32E+07	1.31E+04
Monitor indication with 0.1 uCi/g DE I-131 =	1.98E+06	3.55E+02
Monitor indication with 0.35 uCi/g DE I-131 =	6.94E+06	1.24E+03
Monitor indication with 21 uCi/g DE I-131 =	4.17E+08	7.46E+04
Monitor indication with 300 uCi/g DE I-131 =	5.95E+09	1.07E+06

Values in the tables above are provided without instrument error consideration. If used for an alarm setpoint, the value(s) should be reduced by dividing by 1.37. High alarm setpoints should be set at 50% of the high-high value, or if too close to background indications, at an appropriate value above background so as to avoid spurious alarms. For values calculated that exceed the monitor range of 1.00E+06, an on-scale value appropriate for the application should be used.

REFERENCES

1. SWEC Calculation RP-11700-087-0, Determination of High and High-High Setpoints for all Process and Area Monitors in the BVPS Unit #1 RMS, 1975
2. BVPS Condition Report 990281, Setpoint Discrepancy for RCS Letdown Gross Activity Radiation monitors, Dated 02/12/99
3. BVPS Unit 1 UFSAR Chapter 11, Section 11.3.3.3.16, Reactor Coolant Monitor
4. Unit 1 USNRC SER, Section 11.6, Process and Area Radiation Monitoring Systems
5. Unit 1 OM Chapter 43, 1OM-7.2.B, Setpoints
6. BVPS Onsite Safety Committee Meeting Minutes, BV-OSC-107-81
7. DLCO Calculation ERS-SFL-88-027 Rev. 1, Process Safety Limits and Alarm Setpoints for 2CHS-RQ-101A/B
8. Unit 2 Technical Specification 3/4-.4.4, Specific Activity
9. SWEC Calculation 10080-UR(B)-484, Primary and Secondary Design/Technical Specification Activity Concentrations Including Pre-Accident Iodine Spike Concentrations and Equilibrium Iodine Appearance Rates Following Power Uprate, 2002
10. Chemistry Database for RCS Radioactivity Determinations, Actual Logged Letdown Flow Rates for Unit 1 Cycles 11, 12 and 13
11. BVBP-RP-0002, Radiation Monitor Alarm Setpoint Determination
12. USNRC Regulatory Guide 1.105, Instrument Setpoints
13. 1967 ASME Steam Tables
14. Victoreen VTI 07.503-0110, Section 6, Tables 8 & 9
15. DLCO NED EM Response, EM 1171, NED Verification of EM 116252 (Design basis accident parameter verification – Unit 1) Response, Dated 11/25/98
16. BVPS Unit 1 UFSAR Chapter 9, Table 9.1-2
17. DLCO NED EM Response, EM 116252, Design basis accident parameter verification – Unit 1, Dated 08-01-98
18. Kocher, D. C., Radioactive Decay Tables, Technical Information Center, U. S. Department of Energy, 1981
19. SWEC letter DLS-12168, Beaver Valley Power Station – Unit No. 1 J.O.NO. 11700-O.F.E.NO. 8700 – C.O.NO. 3468, Radiation Monitor Setpoints, October 21, 1975

CH-101 Setpoint Calculation @60 gpm Letdown flow Rate

Updated design RCS concentrations and for the 843-30 detector type

Nuclide	*1% FF @ 576 F (uCi/g)	**At-monitor Density Correction	*1% FF 60 gpm Density Corrected (uCi/cc)	High Range ***Channel Efficiency (cpm-cc/uCi)	1% FF @60 gpm High Range Channel Indication (cpm)	Low Range ***Channel Efficiency (cpm-cc/uCi)	1% FF @60 gpm Low Range Channel Indication (cpm)
Br-84	3.73E-02		3.67E-02	7.0673E+02	2.59E+01	6.5003E+05	2.39E+04
Rb-88	2.75E+00		2.71E+00	3.3324E+02	9.02E+02	1.8750E+05	5.07E+05
Rb-89	1.57E-01		1.54E-01	1.0125E+03	1.56E+02	8.8684E+05	1.37E+05
Sr-89	3.49E-03		3.43E-03	1.6920E-02	5.81E-05	4.4819E+01	1.54E-01
Sr-90	2.16E-04		2.13E-04	0.0000E+00	0.00E+00	0.0000E+00	0.00E+00
Sr-91	1.45E-03		1.43E-03	1.7804E+02	2.54E-01	6.9789E+05	9.96E+02
Sr-92	1.03E-03		1.01E-03	5.8336E+02	5.91E-01	4.6832E+05	4.75E+02
Y-90	5.94E-05		5.84E-05	2.1300E-01	1.24E-05	9.5400E+01	5.58E-03
Y-91	4.78E-04		4.70E-04	1.3596E+00	6.39E-04	1.4543E+03	6.84E-01
Y-92	8.84E-04		8.70E-04	6.7325E+01	5.86E-02	1.1881E+05	1.03E+02
Zr-95	6.32E-04		6.22E-04	8.8200E+01	5.48E-02	4.9537E+05	3.08E+02
Nb-95	6.41E-04		6.31E-04	1.0250E+02	6.47E-02	5.0437E+05	3.18E+02
Mo-99	7.62E-01		7.50E-01	1.6074E+01	1.21E+01	1.2222E+05	9.16E+04
Tc-99m	4.09E-01		4.02E-01	3.0000E-02	1.21E-02	4.4085E+05	1.77E+05
I-129	1.11E-07		1.09E-07	0.0000E+00	0.00E+00	0.0000E+00	0.00E+00
I-131	2.89E+00		2.84E+00	8.6362E+00	2.46E+01	4.8206E+05	1.37E+06
I-132	1.13E+00		1.11E+00	4.3446E+02	4.83E+02	1.5435E+06	1.72E+06
I-133	4.32E+00		4.25E+00	6.4390E+01	2.74E+02	5.3280E+05	2.26E+06
I-134	6.32E-01		6.22E-01	5.4811E+02	3.41E+02	1.3588E+06	8.45E+05
I-135	2.48E+00		2.44E+00	7.8131E+02	1.91E+03	6.7981E+05	1.66E+06
Co-58	1.38E-02		1.36E-02	1.4106E+02	1.92E+00	6.5859E+05	8.94E+03
Co-60	1.59E-03		1.56E-03	1.0207E+03	1.60E+00	9.6841E+05	1.52E+03
Fe-59	9.00E-04		8.86E-04	4.3408E+02	3.84E-01	5.0432E+05	4.47E+02
Te-129	1.43E-02	0.9840	1.41E-02	7.7144E+00	1.09E-01	9.3730E+04	1.32E+03
Te-132	3.00E-01		2.95E-01	3.4826E-01	1.03E-01	4.4459E+05	1.31E+05
Te-134	2.99E-02		2.94E-02	2.0382E-01	6.00E-03	2.8864E+05	8.49E+03
Cs-134	6.05E+00		5.95E+00	2.0187E+02	1.20E+03	1.1422E+06	6.80E+06
Cs-136	1.50E+00		1.48E+00	4.8303E+02	7.13E+02	1.5456E+06	2.28E+06
Cs-137	3.79E+00		3.73E+00	5.1000E+01	1.90E+02	4.3258E+05	1.61E+06
Cs-138	1.03E+00		1.01E+00	9.9875E+02	1.01E+03	8.1615E+05	8.27E+05
Ba-140	4.10E-03		4.03E-03	1.0006E+01	4.04E-02	2.5622E+05	1.03E+03
La-140	1.41E-03		1.39E-03	9.8104E+02	1.36E+00	9.2029E+05	1.28E+03
Ce-144	4.69E-04		4.61E-04	3.1167E-03	1.44E-06	5.5762E+04	2.57E+01
Pr-144	4.72E-04		4.64E-04	1.3164E+01	6.11E-03	1.2369E+04	5.74E+00
Kr-85	1.25E+02		1.23E+02	9.1200E-02	1.12E+01	2.0185E+03	2.48E+05
Kr-85m	1.42E+00		1.40E+00	2.7263E-01	3.81E-01	4.2749E+05	5.97E+05
Kr-87	9.48E-01		9.33E-01	6.2626E+02	5.84E+02	6.9058E+05	6.44E+05
Kr-88	2.65E+00		2.61E+00	5.0762E+02	1.32E+03	5.3234E+05	1.39E+06
Xe-133	3.11E+02		3.06E+02	0.0000E+00	0.00E+00	3.5335E+04	1.08E+07
Xe-133m	4.20E+00		4.13E+00	5.7826E-02	2.39E-01	6.9178E+04	2.86E+05
Xe-135	9.64E+00		9.49E+00	1.8987E+00	1.80E+01	4.6560E+05	4.42E+06
Xe-135m	9.56E-01		9.41E-01	2.0320E+01	1.91E+01	4.0401E+05	3.80E+05
Xe-138	6.70E-01		6.59E-01	1.4864E+03	9.80E+02	1.4879E+06	9.81E+05
Mn-54	4.80E-03		4.72E-03	1.4208E+02	6.71E-01	5.0129E+05	2.37E+03
					1.02E+04		**4.02E+07**
						0.05% FF >	**2.01E+06**
					7.44E+03	**/1.37 error**	**1.47E+06**
					cpm		**cpm**

*1% FF RCS concentrations from SWEC 10080-UR(B)-484 Table 8a

**Letdown density correction based on 137 F (monitor high temperature isolation) = 61.43 lbm/ft3 / 62.43 lbm/ft3

*** Manufacturer calibration data

Beaver Valley Power Station

Radiation Protection Technical Position/Evaluation/Calculation	REVISION: 3	
Subject: **Unit 1 Letdown Radiation Monitor (RM-1CH-101) Alarm Setpoint Calculation and Emergency Action Level (EAL) Value Determination**	No.: ERS-JTL-99-005	Page: 10

RCS Specific Activity Determination With Letdown Flow Rate Increased to 105 gpm

Parameters for correction to 105 gpm letdown flow rate:

RCS mass (average of 0% - 22% S/G tubes plugged) =	1.808E+08	grams
Letdown **mass flow rate at 60 gpm =	3.725E+03	grams/s
Letdown **mass flow rate at 105 gpm =	6.518E+03	grams/s

Nuclide	*1% FF @ 576 F (uCi/g)	Total RCS Activity (uCi)	(Kocher 1981) $t_{1/2}$ (s)	λ Decay (s^{-1})	@60 gpm λ Letdown (s^{-1})	λ Effective (s^{-1})	1% FF RCS removal rate @60 gpm (uCi/s)	*@105 gpm λ Letdown (s^{-1})*	*@105 gpm λ Effective (s^{-1})*	*Total RCS Activity (uCi)*	*1% FF @ 576 F (uCi/g)*
Br-84	3.73E-02	6.75E+06	1.91E+03	3.63E-04		3.84E-04	2.59E+03		3.99E-04	6.48E+06	3.59E-02
Rb-88	2.75E+00	4.97E+08	1.07E+03	6.49E-04		6.70E-04	3.33E+05		6.85E-04	4.86E+08	2.69E+00
Rb-89	1.57E-01	2.84E+07	9.26E+02	7.48E-04		7.69E-04	2.18E+04		7.84E-04	2.78E+07	1.54E-01
Sr-89	3.49E-03	6.31E+05	4.37E+06	1.59E-07		2.08E-05	1.31E+01		3.62E-05	3.62E+05	2.00E-03
Sr-90	2.16E-04	3.91E+04	9.02E+08	7.69E-10		2.06E-05	8.05E-01		3.60E-05	2.23E+04	1.23E-04
Sr-91	1.45E-03	2.62E+05	3.42E+04	2.03E-05		4.09E-05	1.07E+01		5.63E-05	1.90E+05	1.05E-03
Sr-92	1.03E-03	1.86E+05	9.76E+03	7.10E-05		9.16E-05	1.71E+01		1.07E-04	1.59E+05	8.81E-04
Y-90	5.94E-05	1.07E+04	2.31E+05	3.00E-06		2.36E-05	2.54E-01		3.90E-05	6.49E+03	3.59E-05
Y-91	4.78E-04	8.64E+04	5.06E+06	1.37E-07		2.07E-05	1.79E+00		3.62E-05	4.95E+04	2.74E-04
Y-92	8.84E-04	1.60E+05	1.27E+04	5.44E-05		7.50E-05	1.20E+01		9.04E-05	1.33E+05	7.33E-04
Zr-95	6.32E-04	1.14E+05	5.53E+06	1.25E-07		2.07E-05	2.37E+00		3.62E-05	6.55E+04	3.62E-04
Nb-95	6.41E-04	1.16E+05	3.03E+06	2.29E-07		2.08E-05	2.41E+00		3.63E-05	6.66E+04	3.68E-04
Mo-99	7.62E-01	1.38E+08	2.38E+05	2.92E-06		2.35E-05	3.24E+03		3.90E-05	8.32E+07	4.60E-01
Tc-99m	4.09E-01	7.40E+07	2.17E+04	3.20E-05		5.26E-05	3.89E+03		6.80E-05	5.72E+07	3.16E-01
I-129	1.11E-07	2.01E+01	4.95E+14	1.40E-15		2.06E-05	4.13E-04		3.60E-05	1.15E+01	6.34E-08
I-131	2.89E+00	5.23E+08	6.95E+05	9.98E-07	2.06E-05	2.16E-05	1.13E+04	3.60E-05	3.70E-05	3.05E+08	1.68E+00
I-132	1.13E+00	2.04E+08	8.28E+03	8.37E-05		1.04E-04	2.13E+04		1.20E-04	1.78E+08	9.84E-01
I-133	4.32E+00	7.81E+08	7.49E+04	9.26E-06		2.99E-05	2.33E+04		4.53E-05	5.15E+08	2.85E+00
I-134	6.32E-01	1.14E+08	3.16E+03	2.20E-04		2.40E-04	2.75E+04		2.56E-04	1.07E+08	5.94E-01
I-135	2.48E+00	4.48E+08	2.38E+04	2.91E-05		4.97E-05	2.23E+04		6.52E-05	3.42E+08	1.89E+00
Co-58	1.38E-02	2.50E+06	6.12E+06	1.13E-07		2.07E-05	5.17E+01		3.62E-05	1.43E+06	7.90E-03
Co-60	1.59E-03	2.88E+05	1.66E+08	4.17E-09		2.06E-05	5.92E+00		3.60E-05	1.64E+05	9.09E-04
Fe-59	9.00E-04	1.63E+05	3.86E+06	1.80E-07		2.08E-05	3.38E+00		3.62E-05	9.33E+04	5.16E-04
Te-129*	1.43E-02	2.59E+06	4.18E+03	1.66E-04		1.87E-04	4.82E+02		2.02E-04	2.39E+06	1.32E-02
Te-132	3.00E-01	5.43E+07	2.82E+05	2.46E-06		2.31E-05	1.25E+03		3.85E-05	3.25E+07	1.80E-01
Te-134	2.99E-02	5.41E+06	2.51E+03	2.76E-04		2.97E-04	1.61E+03		3.12E-04	5.14E+06	2.84E-02
Cs-134	6.05E+00	1.09E+09	6.50E+07	1.07E-08		2.06E-05	2.25E+04		3.61E-05	6.25E+08	3.46E+00
Cs-136	1.50E+00	2.71E+08	1.14E+06	6.10E-07		2.12E-05	5.75E+03		3.67E-05	1.57E+08	8.68E-01
Cs-137	3.79E+00	6.85E+08	9.51E+08	7.29E-10		2.06E-05	1.41E+04		3.60E-05	3.92E+08	2.17E+00
Cs-138	1.03E+00	1.86E+08	1.93E+03	3.59E-04		3.79E-04	7.07E+04		3.95E-04	1.79E+08	9.90E-01
Ba-140	4.10E-03	7.41E+05	1.10E+06	6.27E-07		2.12E-05	1.57E+01		3.67E-05	4.29E+05	2.37E-03
La-140	1.41E-03	2.55E+05	1.45E+05	4.79E-06		2.54E-05	6.47E+00		4.08E-05	1.59E+05	8.77E-04
Ce-144	4.69E-04	8.48E+04	3.48E+07	1.99E-08		2.06E-05	1.75E+00		3.61E-05	4.85E+04	2.68E-04
Pr-144	4.72E-04	8.54E+04	1.04E+03	6.69E-04		6.89E-04	5.88E+01		7.05E-04	8.35E+04	4.62E-04
Kr-85	1.25E+02	2.26E+10	3.38E+08	2.05E-09		2.06E-05	4.66E+05		3.60E-05	1.29E+10	7.14E+01
Kr-85m	1.42E+00	2.57E+08	1.61E+04	4.30E-05		6.36E-05	1.63E+04		7.90E-05	2.07E+08	1.14E+00
Kr-87	9.48E-01	1.71E+08	4.58E+03	1.51E-04		1.72E-04	2.95E+04		1.87E-04	1.57E+08	8.70E-01
Kr-88	2.65E+00	4.79E+08	1.02E+04	6.78E-05	2.06E-05	8.84E-05	4.24E+04	3.60E-05	1.04E-04	4.08E+08	2.26E+00
Xe-133	3.11E+02	5.62E+10	4.53E+05	1.53E-06		2.21E-05	1.24E+06		3.76E-05	3.31E+10	1.83E+02
Xe-133m	4.20E+00	7.60E+08	1.89E+05	3.66E-06		2.43E-05	1.84E+04		3.97E-05	4.64E+08	2.57E+00
Xe-135	9.64E+00	1.74E+09	3.28E+04	2.11E-05		4.17E-05	7.28E+04		5.72E-05	1.27E+09	7.04E+00
Xe-135m	9.56E-01	1.73E+08	9.22E+02	7.52E-04		7.73E-04	1.34E+05		7.88E-04	1.69E+08	9.37E-01
Xe-138	6.70E-01	1.21E+08	8.48E+02	8.18E-04		8.38E-04	1.02E+05		8.54E-04	1.19E+08	6.58E-01
Mn-54	4.80E-03	8.68E+05	2.70E+07	2.57E-08		2.06E-05	1.79E+01		3.61E-05	4.96E+05	2.74E-03

*1% FF RCS concentrations from SWEC 10080-UR(B)-484 Table 8a

**Letdown density correction based on 137 F (monitor high temperature isolation) = 61.43 lbm/ft3 / 62.43 lbm/ft3

*** Effective removal rate constant = decay removal rate constant + letdown removal rate constant

Beaver Valley Power Station

Radiation Protection Technical Position/Evaluation/Calculation	REVISION: [redacted] 3	
Subject: **Unit 1 Letdown Radiation Monitor (RM-1CH-101) Alarm Setpoint Calculation and Emergency Action Level (EAL) Value Determination**	No.: ERS-JTL-99-005	Page: 11

CH-101 Setpoint Calculation @105 gpm Letdown flow Rate

Updated design RCS concentrations and for the 843-30 detector type

Nuclide	1% FF @ 576 F (uCi/g)	**At-monitor Density Correction	*1% FF 105 gpm Density Corrected (uCi/cc)	High Range ***Channel Efficiency (cpm-cc/uCi)	1% FF @105 gpm High Range Channel Indication (cpm)	Low Range ***Channel Efficiency (cpm-cc/uCi)	1% FF @105 gpm Low Range Channel Indication (cpm)
Br-84	3.59E-02		3.53E-02	7.0673E+02	2.49E+01	6.5003E+05	2.29E+04
Rb-88	2.69E+00		2.64E+00	3.3324E+02	8.81E+02	1.8750E+05	4.96E+05
Rb-89	1.54E-01		1.51E-01	1.0125E+03	1.53E+02	8.8684E+05	1.34E+05
Sr-89	2.00E-03		1.97E-03	1.6920E-02	3.33E-05	4.4819E+01	8.82E-02
Sr-90	1.23E-04		1.21E-04	0.0000E+00	0.00E+00	0.0000E+00	0.00E+00
Sr-91	1.05E-03		1.04E-03	1.7804E+02	1.84E-01	6.9789E+05	7.23E+02
Sr-92	8.81E-04		8.67E-04	5.8336E+02	5.06E-01	4.6832E+05	4.06E+02
Y-90	3.59E-05		3.53E-05	2.1300E-01	7.52E-06	9.5400E+01	3.37E-03
Y-91	2.74E-04		2.70E-04	1.3596E+00	3.66E-04	1.4543E+03	3.92E-01
Y-92	7.33E-04		7.21E-04	6.7325E+01	4.86E-02	1.1881E+05	8.57E+01
Zr-95	3.62E-04		3.56E-04	8.8200E+01	3.14E-02	4.9537E+05	1.76E+02
Nb-95	3.68E-04		3.62E-04	1.0250E+02	3.71E-02	5.0437E+05	1.83E+02
Mo-99	4.60E-01		4.53E-01	1.6074E+01	7.27E+00	1.2222E+05	5.53E+04
Tc-99m	3.16E-01		3.11E-01	3.0000E-02	9.33E-03	4.4085E+05	1.37E+05
I-129	6.34E-08		6.24E-08	0.0000E+00	0.00E+00	0.0000E+00	0.00E+00
I-131	1.68E+00		1.66E+00	8.6362E+00	1.43E+01	4.8206E+05	7.99E+05
I-132	9.84E-01		9.68E-01	4.3446E+02	4.21E+02	1.5435E+06	1.49E+06
I-133	2.85E+00		2.80E+00	6.4390E+01	1.80E+02	5.3280E+05	1.49E+06
I-134	5.94E-01		5.84E-01	5.4811E+02	3.20E+02	1.3588E+06	7.94E+05
I-135	1.89E+00		1.86E+00	7.8131E+02	1.45E+03	6.7981E+05	1.27E+06
Co-58	7.90E-03		7.78E-03	1.4106E+02	1.10E+00	6.5859E+05	5.12E+03
Co-60	9.09E-04		8.94E-04	1.0207E+03	9.13E-01	9.6841E+05	8.66E+02
Fe-59	5.16E-04		5.08E-04	4.3408E+02	2.20E-01	5.0432E+05	2.56E+02
Te-129	1.32E-02	0.9840	1.30E-02	7.7144E+00	1.00E-01	9.3730E+04	1.22E+03
Te-132	1.80E-01		1.77E-01	3.4826E-01	6.16E-02	4.4459E+05	7.86E+04
Te-134	2.84E-02		2.80E-02	2.0382E-01	5.70E-03	2.8864E+05	8.07E+03
Cs-134	3.46E+00		3.40E+00	2.0187E+02	6.87E+02	1.1422E+06	3.89E+06
Cs-136	8.68E-01		8.54E-01	4.8303E+02	4.12E+02	1.5456E+06	1.32E+06
Cs-137	2.17E+00		2.13E+00	5.1000E+01	1.09E+02	4.3258E+05	9.22E+05
Cs-138	9.90E-01		9.74E-01	9.9875E+02	9.73E+02	8.1615E+05	7.95E+05
Ba-140	2.37E-03		2.33E-03	1.0006E+01	2.34E-02	2.5622E+05	5.98E+02
La-140	8.77E-04		8.63E-04	9.8104E+02	8.46E-01	9.2029E+05	7.94E+02
Ce-144	2.68E-04		2.64E-04	3.1167E-03	8.22E-07	5.5762E+04	1.47E+01
Pr-144	4.62E-04		4.54E-04	1.3164E+01	5.98E-03	1.2369E+04	5.62E+00
Kr-85	7.14E+01		7.03E+01	9.1200E-02	6.41E+00	2.0185E+03	1.42E+05
Kr-85m	1.14E+00		1.12E+00	2.7263E-01	3.06E-01	4.2749E+05	4.81E+05
Kr-87	8.70E-01		8.56E-01	6.2626E+02	5.36E+02	6.9058E+05	5.91E+05
Kr-88	2.26E+00		2.22E+00	5.0762E+02	1.13E+03	5.3234E+05	1.18E+06
Xe-133	1.83E+02		1.80E+02	0.0000E+00	0.00E+00	3.5335E+04	6.37E+06
Xe-133m	2.57E+00		2.52E+00	5.7826E-02	1.46E-01	6.9178E+04	1.75E+05
Xe-135	7.04E+00		6.92E+00	1.8987E+00	1.31E+01	4.6560E+05	3.22E+06
Xe-135m	9.37E-01		9.22E-01	2.0320E+01	1.87E+01	4.0401E+05	3.73E+05
Xe-138	6.58E-01		6.47E-01	1.4864E+03	9.62E+02	1.4879E+06	9.63E+05
Mn-54	2.74E-03		2.70E-03	1.4208E+02	3.84E-01	5.0129E+05	1.35E+03
					8.31E+03		**2.72E+07**
						0.05% FF >	**1.36E+06**
					6.06E+03	**/1.37 error**	**9.93E+05**
					cpm		***cpm***

*1% FF RCS concentrations from SWEC 10080-UR(B)-484 Table 8a

**Letdown density correction based on 137 F (monitor high temperature isolation) = 61.43 lbm/ft3 / 62.43 lbm/ft3

*** Manufacturer calibration data

CH-101 Setpoint Calculation @60 gpm Letdown flow Rate

Updated design RCS concentrations and for the 843-30R detector type

Nuclide	*1% FF @ 576 F (uCi/g)	**At-monitor Density Correction	*1% FF 60 gpm Density Corrected (uCi/cc)	High Range ***Channel Efficiency (cpm-cc/uCi)	1% FF @60 gpm High Range Channel Indication (cpm)	Low Range ***Channel Efficiency (cpm-cc/uCi)	1% FF @60 gpm Low Range Channel Indication (cpm)
Br-84	3.73E-02		3.67E-02	2.29E+03	8.40E+01	2.11E+06	7.74E+04
Rb-88	2.75E+00		2.71E+00	3.69E+02	9.98E+02	2.08E+05	5.63E+05
Rb-89	1.57E-01		1.54E-01	9.76E+02	1.51E+02	8.57E+05	1.32E+05
Sr-89	3.49E-03		3.43E-03	2.13E-02	7.31E-05	5.62E+01	1.93E-01
Sr-90	2.16E-04		2.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-91	1.45E-03		1.43E-03	2.08E+02	2.97E-01	8.13E+05	1.16E+03
Sr-92	1.03E-03		1.01E-03	6.27E+02	6.35E-01	5.25E+05	5.32E+02
Y-90	5.94E-05		5.84E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-91	4.78E-04		4.70E-04	1.33E+00	6.26E-04	1.41E+03	6.63E-01
Y-92	8.84E-04		8.70E-04	7.84E+01	6.82E-02	1.39E+05	1.21E+02
Zr-95	6.32E-04		6.22E-04	1.09E+02	6.78E-02	6.09E+05	3.79E+02
Nb-95	6.41E-04		6.31E-04	1.27E+02	8.01E-02	6.19E+05	3.90E+02
Mo-99	7.62E-01		7.50E-01	7.99E+01	5.99E+01	6.05E+05	4.54E+05
Tc-99m	4.09E-01		4.02E-01	3.73E-02	1.50E-02	5.47E+05	2.20E+05
I-129	1.11E-07		1.09E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131	2.89E+00		2.84E+00	9.21E+00	2.62E+01	5.66E+05	1.61E+06
I-132	1.13E+00		1.11E+00	5.16E+02	5.74E+02	1.81E+06	2.01E+06
I-133	4.32E+00		4.25E+00	7.56E+01	3.21E+02	6.57E+05	2.79E+06
I-134	6.32E-01		6.22E-01	6.44E+02	4.00E+02	2.06E+06	1.28E+06
I-135	2.48E+00		2.44E+00	9.62E+02	2.35E+03	7.25E+05	1.77E+06
Co-58	1.38E-02		1.36E-02	1.28E+02	1.74E+00	6.01E+05	8.16E+03
Co-60	1.59E-03		1.56E-03	1.15E+03	1.80E+00	1.08E+06	1.69E+03
Fe-59	9.00E-04		8.86E-04	4.90E+02	4.34E-01	5.69E+05	5.04E+02
Te-129	1.43E-02	0.9840	1.41E-02	1.17E+01	1.65E-01	1.11E+05	1.56E+03
Te-132	3.00E-01		2.95E-01	3.59E-01	1.06E-01	4.59E+05	1.35E+05
Te-134	2.99E-02		2.94E-02	2.34E-01	6.88E-03	3.31E+05	9.74E+03
Cs-134	6.05E+00		5.95E+00	2.46E+02	1.46E+03	1.39E+06	8.27E+06
Cs-136	1.50E+00		1.48E+00	5.50E+02	8.12E+02	1.77E+06	2.61E+06
Cs-137	3.79E+00		3.73E+00	5.92E+01	2.21E+02	5.03E+05	1.88E+06
Cs-138	1.03E+00		1.01E+00	1.29E+03	1.31E+03	1.05E+06	1.06E+06
Ba-140	4.10E-03		4.03E-03	1.09E+01	4.40E-02	2.80E+05	1.13E+03
La-140	1.41E-03		1.39E-03	1.09E+03	1.51E+00	1.02E+06	1.42E+03
Ce-144	4.69E-04		4.61E-04	3.99E-03	1.84E-06	7.16E+04	3.30E+01
Pr-144	4.72E-04		4.64E-04	1.36E+01	6.32E-03	1.28E+04	5.94E+00
Kr-85	1.25E+02		1.23E+02	1.07E+01	1.32E+03	2.37E+05	2.92E+07
Kr-85m	1.42E+00		1.40E+00	3.20E-01	4.47E-01	5.01E+05	7.00E+05
Kr-87	9.48E-01		9.33E-01	6.60E+02	6.16E+02	7.28E+05	6.79E+05
Kr-88	2.65E+00		2.61E+00	5.14E+02	1.34E+03	5.38E+05	1.40E+06
Xe-133	3.11E+02		3.06E+02	0.00E+00	0.00E+00	3.27E+04	1.00E+07
Xe-133m	4.20E+00		4.13E+00	5.98E-02	2.47E-01	7.16E+04	2.96E+05
Xe-135	9.64E+00		9.49E+00	1.97E+00	1.87E+01	4.84E+05	4.59E+06
Xe-135m	9.56E-01		9.41E-01	2.40E+01	2.26E+01	4.78E+05	4.50E+05
Xe-138	6.70E-01		6.59E-01	1.55E+03	1.02E+03	1.55E+06	1.02E+06
Mn-54	4.80E-03		4.72E-03	1.73E+02	8.17E-01	6.10E+05	2.88E+03
					1.31E+04		**7.32E+07**
						0.05% FF >	**3.66E+06**
					9.57E+03	**x1.37 error**	**2.67E+06**
					cpm		**cpm**

*1% FF RCS concentrations from SWEC 10080-UR(B)-484 Table 8a

**Letdown density correction based on 137 F (monitor high temperature isolation) = 61.43 lbm/ft3 / 62.43 lbm/ft3

*** *Manufacturer calibration data*

Beaver Valley Power Station

Radiation Protection Technical Position/Evaluation/Calculation	REVISION: [redacted] 3	
Subject: **Unit 1 Letdown Radiation Monitor (RM-1CH-101) Alarm Setpoint Calculation and Emergency Action Level (EAL) Value Determination**	No.: ERS-JTL-99-005	Page: 13

CH-101 Setpoint Calculation @105 gpm Letdown flow Rate

Updated design RCS concentrations and for the 843-30R detector type

Nuclide	1% FF @ 576 F (uCi/g)	**At-monitor Density Correction	*1% FF 105 gpm Density Corrected (uCi/cc)	High Range ***Channel Efficiency (cpm-cc/uCi)	1% FF @105 gpm High Range Channel Indication (cpm)	Low Range ***Channel Efficiency (cpm-cc/uCi)	1% FF @105 gpm Low Range Channel Indication (cpm)
Br-84	3.59E-02		3.53E-02	2.29E+03	8.08E+01	2.11E+06	7.44E+04
Rb-88	2.69E+00		2.64E+00	3.69E+02	9.76E+02	2.08E+05	5.50E+05
Rb-89	1.54E-01		1.51E-01	9.76E+02	1.48E+02	8.57E+05	1.30E+05
Sr-89	2.00E-03		1.97E-03	2.13E-02	4.19E-05	5.62E+01	1.11E-01
Sr-90	1.23E-04		1.21E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-91	1.05E-03		1.04E-03	2.08E+02	2.15E-01	8.13E+05	8.42E+02
Sr-92	8.81E-04		8.67E-04	6.27E+02	5.44E-01	5.25E+05	4.55E+02
Y-90	3.59E-05		3.53E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-91	2.74E-04		2.70E-04	1.33E+00	3.58E-04	1.41E+03	3.80E-01
Y-92	7.33E-04		7.21E-04	7.84E+01	5.65E-02	1.39E+05	1.00E+02
Zr-95	3.62E-04		3.56E-04	1.09E+02	3.88E-02	6.09E+05	2.17E+02
Nb-95	3.68E-04		3.62E-04	1.27E+02	4.60E-02	6.19E+05	2.24E+02
Mo-99	4.60E-01		4.53E-01	7.99E+01	3.62E+01	6.05E+05	2.74E+05
Tc-99m	3.16E-01		3.11E-01	3.73E-02	1.16E-02	5.47E+05	1.70E+05
I-129	6.34E-08		6.24E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131	1.68E+00		1.66E+00	9.21E+00	1.53E+01	5.66E+05	9.38E+05
I-132	9.84E-01		9.68E-01	5.16E+02	5.00E+02	1.81E+06	1.75E+06
I-133	2.85E+00		2.80E+00	7.56E+01	2.12E+02	6.57E+05	1.84E+06
I-134	5.94E-01		5.84E-01	6.44E+02	3.76E+02	2.06E+06	1.20E+06
I-135	1.89E+00		1.86E+00	9.62E+02	1.79E+03	7.25E+05	1.35E+06
Co-58	7.90E-03		7.78E-03	1.28E+02	9.96E-01	6.01E+05	4.67E+03
Co-60	9.09E-04		8.94E-04	1.15E+03	1.03E+00	1.08E+06	9.66E+02
Fe-59	5.16E-04		5.08E-04	4.90E+02	2.49E-01	5.69E+05	2.89E+02
Te-129	1.32E-02	0.9840	1.30E-02	1.17E+01	1.52E-01	1.11E+05	1.44E+03
Te-132	1.80E-01		1.77E-01	3.59E-01	6.35E-02	4.59E+05	8.11E+04
Te-134	2.84E-02		2.80E-02	2.34E-01	6.54E-03	3.31E+05	9.26E+03
Cs-134	3.46E+00		3.40E+00	2.46E+02	8.37E+02	1.39E+06	4.73E+06
Cs-136	8.68E-01		8.54E-01	5.50E+02	4.70E+02	1.77E+06	1.51E+06
Cs-137	2.17E+00		2.13E+00	5.92E+01	1.26E+02	5.03E+05	1.07E+06
Cs-138	9.90E-01		9.74E-01	1.29E+03	1.26E+03	1.05E+06	1.02E+06
Ba-140	2.37E-03		2.33E-03	1.09E+01	2.55E-02	2.80E+05	6.54E+02
La-140	8.77E-04		8.63E-04	1.09E+03	9.40E-01	1.02E+06	8.80E+02
Ce-144	2.68E-04		2.64E-04	3.99E-03	1.05E-06	7.16E+04	1.89E+01
Pr-144	4.62E-04		4.54E-04	1.36E+01	6.18E-03	1.28E+04	5.81E+00
Kr-85	7.14E+01		7.03E+01	1.07E+01	7.52E+02	2.37E+05	1.67E+07
Kr-85m	1.14E+00		1.12E+00	3.20E-01	3.60E-01	5.01E+05	5.63E+05
Kr-87	8.70E-01		8.56E-01	6.60E+02	5.65E+02	7.28E+05	6.23E+05
Kr-88	2.26E+00		2.22E+00	5.14E+02	1.14E+03	5.38E+05	1.19E+06
Xe-133	1.83E+02		1.80E+02	0.00E+00	0.00E+00	3.27E+04	5.89E+06
Xe-133m	2.57E+00		2.52E+00	5.98E-02	1.51E-01	7.16E+04	1.81E+05
Xe-135	7.04E+00		6.92E+00	1.97E+00	1.36E+01	4.84E+05	3.35E+06
Xe-135m	9.37E-01		9.22E-01	2.40E+01	2.21E+01	4.78E+05	4.41E+05
Xe-138	6.58E-01		6.47E-01	1.55E+03	1.00E+03	1.55E+06	1.00E+06
Mn-54	2.74E-03		2.70E-03	1.73E+02	4.67E-01	6.10E+05	1.65E+03
					1.03E+04		**4.66E+07**
						0.05% FF >	**2.33E+06**
					7.54E+03	**x1.37 error**	**1.70E+06**
					cpm		**cpm**

*1% FF RCS concentrations from SWEC 10080-UR(B)-484 Table 8a

**Letdown density correction based on 137 F (monitor high temperature isolation) = 61.43 lbm/ft3 / 62.43 lbm/ft3

*** Manufacturer calibration data

Alarm Setpoint Methodology

DISCUSSION

This appendix describes the bases for the alarm setpoint methodology. Only increasing value alarm setpoints are addressed. A similar methodology could be described for decreasing value alarm setpoints, but these are not applicable to radiation monitoring.

USNRC Regulatory Guide 1.105, Instrument Setpoints [1], provides a regulatory position on setpoints on systems important to safety. The guide provides the following definition of "systems important to safety":

> *"...those systems that are necessary to ensure (1) the integrity of the reactor coolant pressure boundary, (2) the capability to shutdown the reactor and maintain it in a safe condition, or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guideline exposures of 10 CFR Part 100, Reactor Site Criteria...."*

The BVPS Unit 2 UFSAR [2] contains a commitment to this regulatory guide, but the referenced discussion in section 7 of the UFSAR does not specifically address radiation monitors. SWEC addressed RG 1.105 in the development of Unit 2 category 1 radiation monitor setpoints. This issue was addressed by the Radiation Safety Committee in meeting 25-87[3] and a position paper was prepared on this issue [4]. While recognizing the need to consider instrument errors in determining alarm setpoints, this position paper concluded that the regulatory guide was (1) applicable to a subset of the Unit 2 monitors, (2) applicable to only those Unit 1 monitors installed in response to a Unit 2 licensing commitment, and (3) not applicable to effluent monitors (ODCM). This position paper was accepted by the RSC (BV-RSC-27-87) and approved by the OSC (BV-OSC-48-87).

Regulatory Guide 1.105 provides, in part:

> *"...The setpoints should be established with sufficient margin between the technical specification limits for the process variable and the nominal trip setpoint to allow for (a) the inaccuracy of the instrument; (b) uncertainties in the calibration, and (c) the instrument drift that could occur during the interval between calibrations...."*

The methodology employed by SWEC was, as was this appendix, based on ANSI/ISA-S67.04-1988, Setpoints for Nuclear Safety-Related Instrumentation [5], which provides a means to accomplish the above.

DEFINITIONS

Safety Limit [SL] — A limit on an important process variable that is necessary to reasonably protect the integrity of the physical barriers that guard against uncontrolled release of radioactivity [5]. Safety limits are documented in the UFSAR, in technical specification bases, and in other design basis documentation.

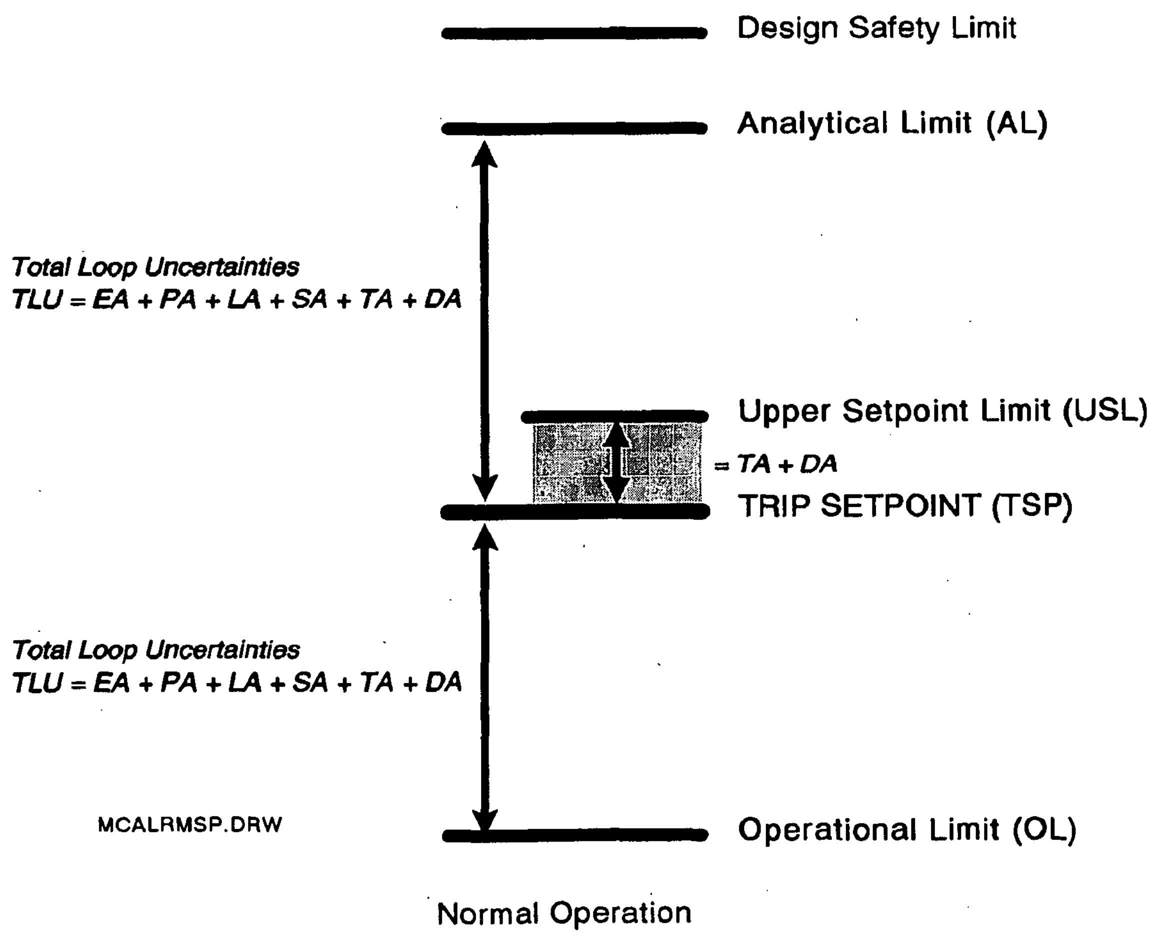
Analytical Limit [AL] — Limit of a measured or calculated variable established by safety analyses to ensure that a safety limit is not exceeded [5]. The difference between a safety limit and an analytical limit provides margin to account for process dependent effects such as (but not limited to) process delays, emergency diesel generator sequencing, valve or damper closure times, and instrument response times.

Trip Setpoint [TSP] — A predetermined value [of the monitored parameter] at which a bistable device changes state to indicate that the quantity under surveillance has reached the selected value [5]. The difference between a trip setpoint and an analytical limit is the allowance provided to account for instrument uncertainty, instrument calibration uncertainty (and, if not addressed in the determination of analytical limit, process dependent effects).

Upper Setpoint Limit [USL] A predetermined value of the monitored parameter above the trip setpoint that, if exceeded during periodic surveillance testing, indicates unsatisfactory instrument performance. The band defined between the trip setpoint and the upper setpoint limit is the allowance provided to account for instrument uncertainties such as setpoint drift, power supply drift, random response variation, deadband, etc.

Operational Limit [OL] The maximum value that the monitored parameter may attain during normal operations, based on administrative controls, that will not result in the occurrence of an alarm.

These quantities are illustrated on the figure below.



DETERMINATION OF ALLOWANCES

Environmental Allowance [EA] Includes the effects of radiation, temperature, pressure, humidity, chemical sprays on the instrumentation. EA should be determined for all safety related monitors expected to operate under accident conditions if the instrument vendor has indicated an accuracy under these conditions that differs from the accuracy expressed for operation under normal conditions. Applies only to QA Category 1 monitors.

Leakage Allowance [LA] Includes instrument signal losses due to cable or penetration leakage or impedence. Applies only to QA Category 1 monitors.

Process Allowance [PA] Includes effects associated with the measurement of the process parameter (e.g., sample line plateout, isokinetic sampling), errors associated with calculation of the process parameter by indirect measurements (e.g., determining flow from Dp measurements).

Calibration Allowance [CA] Includes errors associated with calibrations of the sensor and the readout rack, such as those related to the calibration standard, equipment, and method.

Sensor Allowance [SA] Includes errors associated with the sensor and readout accuracy. Considerations include: linearity; deadtime; energy response linearity; repeatability; power supply stability; temperature, pressure, and humidity changes; ADC/DAC errors, etc.

Drift Allowance [DA] Includes errors due to undesired changes in instrument response, over a period of time, that are independent of the instrument input or use environment. The period of time is normalized to the period between instrument calibrations or surveillance testing.

Tolerance Allowance [TA] Includes administrative tolerances allowed for calibration and/or setpoint adjustment (e.g., adjust to within ± xx% of xxxx cpm).

The errors addressed by these allowances may be dependent or independent. Dependent errors are summed algebraically. Independent errors are summed using the root-of-squared-sums method. Prior to summing, all errors are normalized to a common base (e.g., percent of span, percent of full scale). Unit 1 calibration MSPs provide a tolerance of ±10%. Unit 2 calibration MSPs provide a tolerance of ±15%.

Not all of these allowances are applicable to a particular monitor -- only those applicable are considered. Dependent errors (e.g., LA, CP), are not addressed explicitly if it is reasonable to conclude that sensor-to-readout (end-to-end) calibrations adequately compensate for these effects. In cases where one allowance envelopes a related allowance, only the most restrictive allowance is summed. For example, an instrument setpoint accuracy (i.e., SA) of ±1% is considered enveloped by a tolerance allowance (TA) of ±10%.

The total instrument loop uncertainty (TLU) is the sum of the individual allowances. Assuming LA, to be dependent, and the remainder to be independent:

$$TLU = LA \pm SQRT(EA2 + PA2 + CA2 + SA2 + DA\ 2 + TA\ 2)$$

The trip setpoint equals:

NOTE: In the following, %+TLU refers to the total loop uncertainty in the under-response direction expressed in percent. %-TLU refers to the total loop uncertainty in the over-response direction expressed in percent.

$$TSP = AL - (TLU \times TSP)$$

$$TSP = AL / [\ 1 + (\%\text{-}TLU) / 100\ ]$$

The upper setpoint limit (USL) (NOTE: See definition above.):

USL = TSP + (TSPxDA) + (TSPxTA)

USL = TSP[1 + SQRT(DA2 + TA2)]

The operational limit (OL):

OL = TSP - (TLUxTSP)

OL = TSP[1- (%-TLU/100)]

1. USNRC, Instrument Setpoints, Regulatory Guide 1.105, USGPO ,11/76
2. DLC, BVPS Unit 2 Updated Safety Analysis Report, 1990
3. DLC, Minutes of Radiation Safety Committee Meeting 25-87
4. DLC, Applicability of RG1.105 to BVPS Radiation Monitors, ERS-SFL-87-036, 1987
5. ISA, Setpoints for Nuclear Safety-Related Instrumentation, ANSI/ISA-S67.04-1988
6. Ficke, R, Instrument Setpoint Calculations, presentation at Sorrento Electronics DRMS User's Group Meeting, Fall, 1990

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Date: April 19, 2006

Subject: Revised Model 843-30R Efficiencies

Mr. Vakharia

Enclosed are revised isotopic efficiencies for the Model 843-30R Gamma Scintillation detector used in your liquid and gaseous effluent radiation monitors. Four (4) sets of efficiency tables are enclosed. Each table reflects the efficiency for each of the sampling geometries used in your plant.

The source of the efficiency data is our primary isotopic calibration report 958.402. This report documents the primary isotopic calibration performed on the Model 843-30R detector in our Model 841-334 three (3) Liter Off-line liquid sampling geometry. The Model 841-334 is our current version of your Model 841-3N three (3) liter Off-line sampling geometry. The sample volume and detector location in both sampling geometries is the same, and the data taken with our Model 841-334 will apply directly to your Model 841-3N.

To obtain revised efficiencies for your Letdown monitor and Gaseous effluent monitors, the ratio between your original liquid monitor efficiency and the new efficiency was calculated for each isotope. The efficiency ratio was then applied to the previous letdown monitor and gaseous effluent monitor isotopic efficiencies, and a new efficiency was calculated. We believe this approach is valid because the detector response has been validated in report 958.402. What changes in the letdown and gaseous effluent monitors is the sampling geometry. By knowing the response difference of the detector from the primary liquid isotopic calibration, and the previous response of the letdown and gaseous monitor sampling geometries, a new efficiency for the letdown and gaseous geometries may be obtained by multiplying the original efficiencies by the difference in detector efficiencies.

The results of this analysis are provided on the four (4) tables enclosed.

Please feel free to contact us should you have any questions or comments on the above.

Sincerely Yours,

Andrew Lasko
Project Manager
FLUKE Biomedical
Radiation Management Services
E-Mail: Andrew.Lasko@flukebiomedical.com

Note: Only the portions of the letter attachment that pertain to CH-101 are provided below.

BVPS Unit 1 Reactor Coolant System Letdown Radiation Monitors 4/17/2006

Gamma Sensitivities of the 903664 Sampler & 843-30 High Channel to Liquids

Monitors: RM-1CH-101A **Used as a High Range Instrument**

RM-1CH-101B **Used as a High Range Instrument**

	Nuclide	(1) 843-30 Detection Efficiency (cpm/uCi/ml)	(2) 843-30-R Detection Efficiency (cpm/uCi/ml)
1	Br-84	7.07E+02	2.29E+03
2	Rb-88	3.33E+02	3.69E+02
3	Rb-89	1.01E+03	9.76E+02
4	Sr-89	1.70E-02	2.13E-02
5	Sr-90	0.00E+00	0.00E+00
6	Y-90	2.13E-01	0.00E+00
7	Sr-91	1.78E+02	2.08E+02
8	Y-91	1.36E+00	1.33E+00
9	Sr-92	5.58E+02	6.27E+02
10	Y-92	6.73E+01	7.84E+01
11	Zr-95	8.82E+01	1.09E+02
12	Nb-95	1.03E+02	1.27E+02
13	Mo-99	1.61E+01	7.99E+01
14	Tc-99m	3.00E-02	3.73E-02
15	I-132	4.34E+02	5.16E+02
16	I-133	6.44E+01	7.56E+01
17	I-134	5.48E+02	6.44E+02
18	I-135	7.81E+02	9.62E+02
19	Te-129	7.71E+00	1.17E+01
20	I-131	8.64E+00	9.21E+00
21	Te-132	3.48E-01	3.59E-01
22	Te-134	2.04E-01	2.34E-01
23	Cs-134	2.02E+02	2.46E+02
24	Cs-136	4.83E+02	5.50E+02
25	Cs-137	5.10E+01	5.92E+01
26	Cs-138	9.99E+02	1.29E+03
27	Ba-140	1.00E+01	1.09E+01
28	La-140	9.81E+02	1.09E+03
29	Ce-144	3.11E-03	3.99E-03
30	Pr-144	1.32E+01	1.36E+01
31	Kr-85	9.12E-02	1.07E+01
32	Kr-85m	2.73E-01	3.20E-01
33	Kr-87	6.26E+02	6.60E+02
34	Kr-88	5.08E+02	5.14E+02
35	Xe-133	0.00E+00	0.00E+00
36	Xe-133m	5.78E-02	5.98E-02
37	Xe-135	1.90E+00	1.97E+00
38	Xe-135m	2.03E+01	2.40E+01
39	Xe-138	1.49E+03	1.55E+03
40	Mn-54	1.42E+02	1.73E+02
41	Mn-56	6.74E+02	8.47E+02
42	Co-58	1.41E+02	1.28E+02
43	Co-60	1.03E+03	1.15E+03
44	Fe-59	4.34E+02	4.90E+02

(1) Original Gamma Sensitivities from Addendum to BVPS Spec No. BVS-414, Table V, 10-7-

(2) Gamma Sensitivities from Fluke Biomedical for Replacement Detector

BVPS Unit 1 Reactor Coolant System Letdown Radiation Monitors 4/17/2006

Gamma Sensitivities of the 903664 Sampler & 843-30 Low Channel to Liquids

Monitors: RM-1CH-101A **Used as a Low Range Instrument**
RM-1CH-101B **Used as a Low Range Instrument**

	Nuclide	(1) 843-30 Detection Efficiency (cpm/uCi/ml)	(2) 843-30-R Detection Efficiency (cpm/uCi/ml)
1	Br-84	6.50E+05	2.11E+06
2	Rb-88	1.88E+05	2.08E+05
3	Rb-89	8.87E+05	8.57E+05
4	Sr-89	4.48E+01	5.62E+01
5	Sr-90	0.00E+00	0.00E+00
6	Y-90	9.54E+01	0.00E+00
7	Sr-91	6.97E+05	8.13E+05
8	Y-91	1.45E+03	1.41E+03
9	Sr-92	4.68E+05	5.25E+05
10	Y-92	1.19E+05	1.39E+05
11	Zr-95	4.95E+05	6.09E+05
12	Nb-95	5.04E+05	6.19E+05
13	Mo-99	1.22E+05	6.05E+05
14	Tc-99m	4.40E+05	5.47E+05
15	Te-129	9.37E+04	1.11E+05
16	I-131	~~4.82E+00~~	~~5.66E+00~~
17	I-132	1.54E+06	1.81E+06
18	I-133	5.33E+05	6.57E+05
19	I-134	1.36E+06	2.06E+06
20	I-135	6.80E+05	7.25E+05
21	Te-132	4.45E+05	4.59E+05
22	Te-134	2.89E+05	3.31E+05
23	Cs-134	1.14E+06	1.39E+06
24	Cs-136	1.55E+06	1.77E+06
25	Cs-137	4.33E+05	5.03E+05
26	Cs-138	8.16E+05	1.05E+06
27	Ba-140	2.56E+05	2.80E+05
28	La-140	9.20E+05	1.02E+06
29	Ce-144	5.58E+04	7.16E+04
30	Pr-144	1.24E+04	1.28E+04
31	Kr-85	2.02E+03	2.37E+05
32	Kr-85m	4.27E+05	5.01E+05
33	Kr-87	6.91E+05	7.28E+05
34	Kr-88	5.32E+05	5.38E+05
35	Xe-133	3.53E+04	3.27E+04
36	Xe-133m	6.92E+04	7.16E+04
37	Xe-135	4.66E+05	4.84E+05
38	Xe-135m	4.04E+05	4.78E+05
39	Xe-138	1.49E+06	1.55E+06
40	Mn-54	5.01E+05	6.10E+05
41	Mn-56	7.05E+05	8.86E+05
42	Co-58	6.59E+05	6.01E+05
43	Co-60	9.68E+05	1.08E+06
44	Fe-59	5.04E+05	5.69E+05

4.82E+5 5.66E+5
Corrected values jtl 8/8/11

(1) Original Gamma Sensitivities from Addendum to BVPS Spec No. BVS-414, Table V, 10-7.

(2) Gamma Sensitivities from Fluke Biomedical for Replacement Detector

6. ERS-MPD-93-008, “BVPS – U2 Gaseous Radioactivity Monitor Emergency Action Levels,” Revision 7

Beaver Valley Power Station

Radiation Protection Technical Position/Evaluation/Calculation

Subject	No.	PAGE 1 OF
BVPS – U2 Gaseous Radioactivity Monitor Emergency Action Levels	**ERS-MPD-93-008**	**37**

Reference
HPP____ EPP X T/S ____ CR ____ DCP____

Category

☐ Technical Position ☒ Technical Evaluation ☐ Calculation

Unit 1 ☐ Unit 2 ☒

Purpose

To apply guidance contained in the NUMARC EAL document to the appropriate gaseous radiation monitors at BVPS Unit 2.

Note: This Technical Evaluation is not an implementing document. Any application of the information contained herein must be reviewed and approved using the established review/approval process for that application.

☐ **ORIGINAL ISSUE**

☒ **REVISION # 7**

Revision description:
This revision adds Addendum 1 to calculate the Main Steam monitor EAL values using the release flow rate of 890,000 lbm/hr that was used in revisions previous to Revision 6. This change was requested by Fleet ER, following discussion of the change to 811,237 lbm/hr that was made in Revision 6. It was felt that additional research was needed to determine and justify any change to the Revision 5 value before any new value is used. The calculations performed below do not differ from those performed in Revision 6. Also, Engineering provided a revised steam specific volume for BVPS local baseline atmospheric pressure (14.3 psig) and the main steam system pressure, and this was used in this evaluation. Corrected the evaluation number in the header of the following pages.

by	checker/reviewer	independent review (calculation only)
John T. Lebda 05/10/08 date	J. W. Etzel 5/10/08 date	N/A date

Checklist		Attachments
☒ Purpose	☒ Results	☒ Data Sheets
☒ Methodology	☒ References	☐ Illustrations
☒ Input Data		☐ Printouts
		☐ Code Listings

☒ Transmittal to BVRC	☐ Supt, Rad Ops	☒ Author: John T. Lebda BV-ERF
☒ Original RP ERF FILE	☐ Supv, RP Services	☒ D. Rinkacs BV-SIM
☐ MGR, Radiation Protection	☐ Supv, Rad Waste/Effluents	☐
		☐

DISCUSSION

This technical evaluation uses accident source terms, radiation monitor nuclide detection efficiencies and nuclide dose conversion factors (TEDE and child thyroid) to calculate radiation monitor readings that correspond to offsite doses of 50, 100 and 1000 mrem TEDE and 250, 500 and 5000 mrem child thyroid. These are used as indicators of the Site Area Emergency (SAE) and General Emergency (GE) classifications. Additionally, indicators for the Unusual Event and Alert classifications are derived. These are simply multiples of the ODCM[1] limit, i.e., 2xODCM limit for the Unusual Event (UE) and 200xODCM limit for the Alert. The calculated radiation monitor readings may be used for Emergency Action Level (EAL) determination following an accident with consequent release of radioactivity, and when the results of more rigorous assessments are not available.

Revision History:
This Revision 7 adds Addendum 1 to calculate the Main Steam monitor EAL values using the release flow rate of 890,000 lbm/hr that was used in revisions previous to Revision 6. This change was requested by Fleet ER, following discussion of the change to 811,237 lbm/hr that was made in Revision 6. It was felt that additional research was needed to determine and justify any change to the Revision 5 value before any new value is used. The calculations performed below do not differ from those performed in Revision 6. Also, Engineering provided a revised steam specific volume for BVPS local baseline atmospheric pressure (14.3 psig) and the main steam system pressure, and this was used in this evaluation. Corrected the evaluation number in the header of the following pages.

Revision 6 was done to incorporate revised LOCA source terms from ERS-MPD-01-002[2]. The affected accident source terms are the DBA LOCA, GAP LOCA, RCS LOCA and RCCA. This revision was prompted by changes made to the reactor building containment sump and to the operation of the recirculation spray system. Additional information regarding these changes and the impact on the accident source term may be found in UFSAR design basis radiological consequence calculation, 10080-UR(B)-487[3]. This revision makes a change to the TEDE dose conversion factors for iodine by including the dose contribution from 4-day ground contamination. The 4-day ground contamination dose is included when performing dose projections and including it here is consistent with that application. In addition, calculations from previous revisions (addenda) are removed and any prior changes are incorporated in the main body of this technical evaluation. Also, the original main body was edited and retyped in Microsoft WORD. Used revised steam release valve capacity to 811,237 lbm/h. Removed Fuel Building exhaust monitor as there is not EAL value used for this process monitor.

Revision 5 was made to correct the Technical Evaluation number.

Revision 4 used revised source terms developed to consider the extended power up-rate, atmospheric containment conversion and use of alternate source terms. Replace use of the XRADMON FORTRAN program with mathematically equivalent EXCEL spreadsheets.

Revision 3 used revised source terms developed to consider the extended power up-rate, atmospheric containment conversion and use of alternate source terms. The results from this revision were never implemented.

Revision 2 updated the calculations using revised source terms.

Revision 1 updated results for the mid-range WRGM due to use of a different detector.

METHODOLOGY

The bases for the EAL values for the four emergency classifications are:

UE ODCM limit multiplied by two (x2)

Alert ODCM limit multiplied by two-hundred (x200) for effluent monitors.

SAE Effluent pathway radiation monitor indication that corresponds to 100 mrem TEDE or 500 mrem child thyroid at the site boundary. The lower of the two values is used.

GE Effluent pathway radiation monitor indication that corresponds to 1000 mrem TEDE or 5000 mrem child thyroid at the site boundary. The lower of the two values is used.

For the SAE and GE calculations a release duration is necessary to calculate an integrated dose. Consistent with previous revisions and the NUMARC EAL document[4], a release duration of one hour is used. All of the UFSAR accidents that have a radiological consequence analysis, and several variants of the Loss of Coolant Accident (LOCA) are considered, each having a unique source term. The radiation monitor EAL for each radiation monitor is the lowest monitor indication calculated among all accident types.

The original calculation methodology (used in XRADMON) is:

The fraction of each isotope in the accident source term is calculated

$$\mathbf{S_i = A_i / \Sigma_i A_i} \quad [1]$$

Since the activity for each isotope is converted to a unitless fraction, the input activity can be expressed in any normal activity units. Note that the input activity is used strictly to determine the activity ratios – the absolute value or units of the input activity has no meaning in subsequent calculations.

The dose rate, DR_t (mrem/h), at a point downwind from a radiological release is equal to:

$$\mathbf{DR_t = Q_t * (X/Q) * (DCF_t) * (1.1408E\text{-}4\ yr/h)} \quad [2]$$

where: Q_t = release rate (uCi/s)
X/Q = dispersion (s/m^3)
DCF_t = dose conversion factor (mrem-m^3/uCi-yr)

$$\mathbf{1.1408E-4 \quad \text{is a unit conversion factor} := \left(\frac{1\,year}{365.25\,day} \cdot \frac{1\,day}{24\,hr}\right)}$$

Re-arranging equation [2] to solve for the release rate yields:

$$\mathbf{Q_t = DR_t\ /\ ((X/Q) * (DCF_t) * (1.1408E\text{-}4)} \quad [3]$$

The dose rate conversion factor for a mixture of nuclides in the sum of the normalized DCFi for each nuclide, I:

$$\mathbf{DCF_t = \Sigma_i S_i * DCF_i} \quad [4]$$

Substituting equation [4] into equation [3] gives:

$$Q_t = DR_t \ / \ ((1.1408E\text{-}4) * (X/Q) * \Sigma_i S_i * DCF_i) \qquad [5]$$

Equation [5] is valid for either TEDE or child thyroid dose, provided the appropriate DCFs are used. In order for the thyroid dose-related monitor reading to be valid, all nuclides must be included in determining S_i. While only radioiodines contribute significantly to thyroid dose, the noble gas nuclides nevertheless contribute to the monitor reading.

Once the release necessary to obtain the desired total dose rate is determined, it can be ratioed by S_i to obtain Q_i, the activity of nuclide i as follows:

$$Q_i = Q_t * S_i$$

To obtain the release concentration, divide by the release flow:

$$C_i = (2.12E\text{-}3 * Q_i) \ / \ flow$$

To obtain the monitor count rate for a single nuclide:

$$CR_i = E_i * C_i$$

Where E_i is the efficiency (cpm/uCi/cc) of the monitor for nuclide i. The count rate for the release as a whole is then:

$$CR_t = \Sigma_i S_i * CR_i$$

At Unit 2, the radiation monitor software uses a conversion factor (CF11) to convert cpm to uCi/cc (and uCi/s for some monitor channels). Because this conversion is nuclide mix specific, the correlation of monitor response to dose requires additional calculations as described later.

The following is a description of the math performed by the EXCEL spreadsheets used in this Technical Evaluation. This has been verified to produce results consistent with the previously used XRADMON application and the math described above.

An EXCEL spreadsheet was made for each accident type and radiation monitor combination that is appropriate for the accident type. Each spreadsheet consists of 15 columns with a row for each radionuclide. At the bottom of each spreadsheet, there is a section used to convert cpm to TEDE and child thyroid. Additionally, each spreadsheet has cells used for inputting release flow rate (cfm) and the atmospheric dispersion factor (X/Q) (s/m^3). Details of all spreadsheet math is provided below:

Column 1 – List of the individual isotopes that comprise the accident source term. Each isotope occupies a row.

Column 2 – Total release quantity (Ci) for each isotope specific to the accident type. These values are taken from ERS-MPD-01-002.

Column 3 – Activity ratio for each nuclide. This is a unitless fraction of the total for each nuclide calculated by:

col 1 / Σ col 1
fraction = Ci / Ci

where A_i is the activity of each individual nuclide.

Column 4 - List of the TEDE dose conversion factors (DCFs) for each radionuclide (mrem-m^3/uCi-yr).

Column 5 – Effective DCF

col 3 * col 4
mrem-m^3/uCi-yr = mrem-m^3/uCi-yr * unitless

Column 6 – Release rate (uCi/s) that, for each nuclide in the specific accident mix, will result in a TEDE rate of 1 mrem per hour of exposure to the total mix. First, math equivalent of equation [5], above is performed in the top section of the spreadsheet and is labeled as (Expression 5). Then, for each nuclide, this is multiplied by the unitless activity fraction in column 3.

col 3 unit rate / (time conversion * X/Q * Σ col 5)
uCi/s = unitless fraction * (1 mrem/h / ((1 yr / 8760 hr) * (s/m^3) * (mrem-m3 / uCi/yr)))

One mrem per hour is selected so that the calculated release rate need only be multiplied by the desired total mrem to calculate that release rate that will cause the total mrem over one hour. The ODCM X/Q associated with the release point for the radiation monitor is entered in a cell on each spreadsheet.

Column 7 – Release concentration (uCi/cc) that, for each nuclide in the specific accident mix, will result in a TEDE rate of 1 mrem per hour of exposure to the total mix.

col 6 / flow rate
uCi/cc = uCi/s / cc/s

The release pathway flow rate (cfm) for the radiation monitor is entered in a cell on each spreadsheet and converted to cc/s.

Column 8 – List of the monitor specific detection efficiencies (cpm/uCi/cc) for each isotope. These values are taken from ERS-SFL-86-026[5].

Column 9 – The radiation monitor count rate (cpm) that, if sustained for 1 hour, will cause 1 mrem TEDE to an individual located at the site boundary.

col 7 / col 8
cpm = uCi/cc / cpm/uCi/cc

Two additional math operations are performed at the bottom of each spreadsheet. First the calculated cpm for 1 mrem is multiplied by the desired dose (50, 100 and 1000 mrem for TEDE). Then these values are multiplied by the current monitor CF11 (uCi/cc-cpm) to calculate the monitor indication (uCi/cc) that corresponds to each of these doses. Again, this applies at the site boundary for a 1 hour exposure duration.

Indicators for child thyroid doses of 250, 500 and 5000 mrem are calculated in the manner described above in columns 10 through 15. The only difference is that TEDE DCFs are replaced with child thyroid DCFs.

The main steam and SLCRS pathway monitors are provided with an effluent channel that converts the release rate in units of uCi/cc to units of uCi/s. EAL values are calculated for these channels using the following unit conversion constants and math:

uCi/s = (calculated EAL uCi/cc) * (pathway flow rate ft^3/min) * (1 min/60 s) * (2.832E4 cc/ft^3)

Consistent with previous methodology, the ERS-MPD-01-002 STGR source term is reduced by 0.01 for the release through the Condensate Polishing Vent because this pathway is filtered.

INPUT DATA / ASSUMPTIONS

1. Release Source Terms [2]

   Iodine reduction is applied as was done in previous revisions for the release via gaseous pathways. This is already applied in ERS-MPD-01-002 for all accidents except the SGTR, MSLB and LRA/LACP. For these accidents (that are not normally associated with a filtered pathway as modeled in the design basis analyses), an iodine reduction factor of 0.01 is applied herein to ERS-MPD-01-002 source terms for use in this evaluation when the monitor is for a pathway expected to be filtered. This reduction factor is also applied for unfiltered pathways, taking credit for other iodine removal mechanisms (plate-out, scavenging by humidity, agglomeration and retention in leakage fluids), again consistent with previous revisions. For releases via the main steam valves, no additional iodine reduction is used for these. Iodine reduction is not applicable for the gaseous waste system failure as this release contains no iodine. Again, iodine reduction as described above is consistent with the intent of the previous revisions and the calculations performed for Unit 1. This is appropriate as these source terms are intended only for use in EPP applications. As such, they are modified to more closely reflect actual plant conditions.

   The release source terms used are shown in the spreadsheet calculation printouts included with this evaluation.

2. Unit 2 release point data [1,6,7]

Release Point	Radiation monitor	Monitor CF11 (uCi/cc-cpm)	Range (uCi/cc)	Pathway flow rate (cfm)	ODCM X/Q (s/m^3)
Ventilation Vent	2HVS-RQ-101B	3.65E-8	3.7E-7 to 3.72E-1	23700	1.03E-4
Condensate Polishing Bldg.	2-HVL-RQ-112B	5.56E-8	5.6E-7 to 5.6E-1	30556	7.35E-5
Supplementary Collection and Release System (SLCRS)	2HVS*RQ-109B	2.45E-8	2.5E-7 to 2.5E-1	59000	9.24E-5
	2HVS*RQ-109C	4.09E-5	3.9E-4 to 3.9E2	59000	9.24E-5
	2HVS*RQ-109D	1.12E-2	8.9E-2 to 8.9E4	59000	9.24E-5
Waste Gas Tank Vault Vent	2RMQ-RQ-303B	2.79E-8	2.8E-7 to 2.8E-1	2000	9.24E-5
Decon Building Vent	2RMQ-RQ-301B	5.56E-8	5.6E-7 to 5.6E-1	12400	9.24E-5
Main Steam Exhaust	2MSS*RQ-101A,B,C	2.50E-4	2.5E-3 to 2.5E3	5474	9.24E-5

The main steam exhaust flow rate in cfm is calculated as follows:
The maximum release rate from an open main steam safety valve of 811,237 lbm/hr[8] at 1075 psig (1089.7 psia) is used at the basis for the main steam exhaust flow rate. The specific volume is 0.40485 ft^3/lb at saturation conditions.

$$5474\ \text{ft}^3/\text{min} = (811237\ \text{lb/hr}) * (0.40485\ \text{ft}^3/\text{lb}) * (1\ \text{hr}/60\ \text{min})$$

For use in the calculations, spreadsheet math is used to convert this to units of cc/s:

$$2.584\text{E}6\ \text{cc/s} = (5474\ \text{ft}^3/\text{min}) * (1\ \text{min}/60\ \text{s}) * (2.832\text{E}4\ \text{cc/ft}^3)$$

In addition to the channels listed above, EAL values will also be calculated for the "effluent channels" of the main steam monitors and 2HVS*RQ-109E. These channels indicate in units of uCi/s. The monitor software calculates indication values for these channels using the uCi/cc values and the pathway flow rate.

3. <u>Radiation monitor nuclide detection efficiencies</u> [5]

Detection efficiencies for each monitor and for each nuclide are listed on each spreadsheet.

4. <u>Dose conversion factors</u> [9]

The TEDE conversion factors (DCFs) are taken from ERS-MPD-91-046[9] (units of mrem-m^3/uCi-yr). In this emergency dose projection application, 4-day dose from ground deposition is included. These DCFs are equivalent to those in EPA Report 400[10] and are expressed with three significant digits.

The child thyroid conversion factors (DCFs) are taken from ERS-MPD-91-046 (units of mrem-m^3/uCi-yr). These were developed from child thyroid DCFs provided in USNRC Regulatory Guide 1.109[11] Table E-9.

All DCFs listed on each spreadsheet.

5. <u>Accident Types</u> [2]

Gap LOCA	Loss of Coolant Accident with release of a fraction of fuel rod gap activity
DBA LOCA	Design Basis Loss of Coolant Accident
RCS LOCA	Loss of Coolant Accident with release of T.S. limit concentration RCS activity
TID LOCA	TID 14844 source term release assumptions (failed ESFs)
SB LOCA	Small break LOCA outside of containment
FHA	Fuel Handling Accident
RCCA	Rod Control Cluster ejection Accident
LACP/LRA	Loss of Non-emergency AC Power/Locked (reactor coolant pump) Rotor Accident
MSLB	Main Steam Line Break
SGTR	Steam Generator Tube Rupture
GWS Fail	Gaseous Waste System Failure

6. <u>Accident Types and Applicable Release Pathways</u>

This technical evaluation provides conversions for all accident source terms for each radiation monitor. Because not all accident types necessarily have a release pathway applicable to each monitor, the following tables are provided to identify the most likely combinations.

Monitor 2HVS-RQ-101B, Ventilation Vent

DBA LOCA, GAP LOCA, RCS LOCA, TID LOCA, RCCA	Leakage via penetrations into contiguous areas
SB LOCA	Leakage into contiguous areas
SGTR, LACP/LRA	No reasonable path to this release point
FHA	Fuel handling accident in containment
GWS, MSLB	No physical pathway

Monitor 2HVL-RQ-112B, Condensate Polishing Building Vent

DBA LOCA, GAP LOCA, RCS LOCA, TID LOCA, RCCA, SB LOCA, FHA, GWS, MSLB, LACP/LRA	No reasonable pathway
SGTR	Via condensate leakage

Monitor 2HVS*RQ-109B, C, D, E (Effluent Channel), SLCRS

DBA LOCA, GAP LOCA, RCS LOCA, TID LOCA, RCCA	Leakage via penetrations into contiguous areas, or to the PAB with diversion
SB LOCA	Leakage into contiguous areas, or to PAB with diversion
FHA	From fuel pool via FHB exhaust or, fuel handling accident in containment
SGTR, LACP/LRA	No likely pathway
GWS, MSLB	No physical pathway

Monitor 2RMQ-RQ-303B, Waste Gas Storage Tank Vault Vent

DBA LOCA, GAP LOCA, RCS LOCA, TID LOCA, RCCA, SB LOCA, FHA, SGTR, MSLB, LACP/LRA	No release via this pathway
GWS	Directly to this release point

Monitor 2RMQ-RQ-301B, Decon Building Vent

DBA LOCA, GAP LOCA, TID LOCA, RCCA, SB LOCA, FHA, SGTR, MSLB, LACP/LRA, GWS	No release via this pathway
RCS LOCA	Selected as a general source term

Monitor 2MSS*RQ-101 Effluent Channel Main Steam Release Point

DBA LOCA, GAP LOCA, TID LOCA, RCCA, SB LOCA, FHA, MSLB, RCS LOCA, LACP/LRA, GWS, Kr-85, Xe-133	No release via this pathway
SGTR, LACP/LRA	Release via a lifted safety valve during the event. SGTR is used as the limiting accident.

7. <u>2HVS*RQ-109E Effluent Channel</u>

The effluent channel of the SLCRS wide range gas monitor (WRGM), 2HVS*RQ-109E, contains software which converts the effluent concentration into a uCi/s release rate. In addition, the software selects a value from one of the three ranges based on a crossover point which is expressed in activity. The value from the low range detector is used until the activity is 1E-2 uCi/cc, then the value from the middle range detector is used. When the activity reaches 1E2 uCi/cc, the high range detector is used to determine the release rate. The software selects the conversions factor from the detector in use at the time the calculation is made. This will affect the calculation of the release rate EALs since the effluent channel may be using any of the three detectors. Consistent with previous revisions, the mid-range detector (2HVS*RQ-109C) is used to calculate the effluent channel EAL.

8. <u>Application of Monitor Background</u>

Because background indication may vary, it is not considered in this technical evaluation. The EAL values calculated herein are net values, and are in addition to normal monitor background indication.

RESULTS

Attachment 1 details the UE and Alert EAL calculations. Attachment 2 and Attachment 3 provide a summary and details of the SAE and GE EAL calculations. No value is shown where the calculated value exceeds the monitor range or, for the main steam monitors, no ODCM limit is specified. The summary of all results is:

Release Point	Radiation monitor	UE	Alert	SAE	GE
Ventilation Vent	2HVS-RQ-101B	6.02E-4 uCi/cc	6.02E-2 uCi/cc	1.67E-1 uCi/cc	out of range
Condensate Polishing Bldg.	2-HVL-RQ-112B	3.22E-3 uCi/cc	3.22E-1 uCi/cc	out of range	out of range
Supplementary Collection and Release System (SLCRS)	2HVS*RQ-109B	2.12E-4 uCi/cc	2.12E-2 uCi/cc	8.13E-2 uCi/cc	out of range
	2HVS*RQ-109C	n/a	n/a	7.26E-2 uCi/cc	7.26E-1 uCi/cc
	2HVS*RQ-109D	n/a	n/a	out of range	6.45E-1 uCi/cc
	2HVS*RQ-109E Effluent Channel	5.88E+3 uCi/s	5.88E+5 uCi/s	1.95E+6 uCi/s	1.95E+7 uCi/s
Waste Gas Tank Vault Vent	2RMQ-RQ-303B	5.16E-2 uCi/cc	out of range	out of range	out of range
Decon Building Vent	2RMQ-RQ-301B	6.30E-3 uCi/cc	out of range	out of range	out of range
Main Steam Exhaust	2MSS*RQ-101A,B,C	n/a	n/a	5.10E-1 uCi/cc	5.10E-0 uCi/cc
Main Steam Exhaust Eff.	2MSS*RQ-101A,B,C Effluent Channels	n/a	n/a	1.47E+6 uCi/s	1.47E+7 uCi/s

REFERENCES

1. BVPS Offsite Dose Calculation Manual (ODCM), 1/2-ODC-2.02.
2. BVPS Technical Evaluation, ERS-MPD-01-002, "Determination of Release Source Terms for BVPS Accidents for Emergency Planning Purposes".
3. SWEC Calculation 10080-UR(B)-487, "Site Boundary, Control Room and Emergency Response Facility Doses following a Loss-of-Coolant Accident Based on Core Uprate, and Atmospheric Containment, and Alternative Source Term Methodology".
4. NUMARC EAL Document
5. BVPS Technical Evaluation ERS-SFL-86-026, "Unit 2 DRMS Isotopic Efficiencies".
6. Unit 2 DRMS Database
7. Procedure 2-HPP-4.02.021, "DRMS Effluent Monitoring Subsystem".
8. BVPS Unit 2 Operating Manual 2OM-21.2B, "Main Steam System, Precautions, Limitations and Setpoints".
9. BVPS Technical Evaluation ERS-MPD-91-046, "Determination of Dose Conversion Factors for Use in EPP Emergency Action Level (EAL) Indicators".
10. USEPA 400-R-92-001, "Manual of Protective Action Guides and Protection Actions for Nuclear Incidents".
11. USNRC Regulatory Guide 1.109, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I".

UE and Alert EAL Calculations:

Release Point	Radiation monitor	ODCM Limit[1]	2 x ODCM Limit	200 x ODCM Limit
Ventilation Vent	2HVS-RQ-101B	3.01E-4 uCi/cc	6.02E-4 uCi/cc	6.02E-2 uCi/cc
Condensate Polishing Bldg.	2-HVL-RQ-112B	1.61E-3 uCi/cc	3.22E-3 uCi/cc	3.22E-1 uCi/cc
Supplementary Collection and Release System (SLCRS)	2HVS*RQ-109B	1.06E-4 uCi/cc[2]	2.12E-4 uCi/cc[2]	2.12E-2 uCi/cc[2]
	2HVS*RQ-109C	—[3]	—[3]	—[3]
	2HVS*RQ-109D	—[3]	—[3]	—[3]
	2HVS*RQ-109E	2.94E+3 uCi/s	5.88E+3 uCi/s	5.88E+5 uCi/s
Waste Gas Tank Vault Vent	2RMQ-RQ-303B	2.58E-2 uCi/cc	5.16E-2 uCi/cc	**
Decon Building Vent	2RMQ-RQ-301B	3.15E-3 uCi/cc	6.30E-3 uCi/cc	**
Main Steam Exhaust	2MSS*RQ-101A,B,C	n/a[4]	n/a[4]	n/a[4]

[1]From 1/2-ODC-2.02
[2]Values are derived by unit conversion of 2HVS-RQ-109E.
[3]These higher range channels are not used for the low concentrations associated with the ODCM limit.
[4]No ODCM limit associated with these monitors.
**Exceeds monitor range.

Calculation Summary:

Ventilation Vent:
2HVS-RQI-101B:

	SAE	GE	
LOCA Gap	7.61E-01	7.61E+00	TEDE
	1.67E-01	1.67E+00	THYROID
DBA LOCA	8.70E-01	8.70E+00	TEDE
	2.47E-01	2.47E+00	THYROID
LOCA RCS	5.89E+00	5.89E+01	TEDE
	1.63E+00	1.63E+01	THYROID
LOCA TID	1.99E-01	1.99E+00	TEDE
	1.98E-01	1.98E+00	THYROID
SB LOCA	6.26E-01	6.26E+00	TEDE
	3.14E-01	3.14E+00	THYROID
FHA	2.85E+00	2.85E+01	TEDE
	6.75E+00	6.75E+01	THYROID
RCCA	1.29E+00	1.29E+01	TEDE
	3.58E+00	3.58E+01	THYROID
Minimum Value =	**1.67E-01**	**1.67E+00**	

Condensate Polishing:
2HVS-RQI-112B:

	SAE	GE	
SGTR	8.22E-01	8.22E+00	TEDE
	1.16E+01	1.16E+02	THYROID
Minimum Value =	**8.22E-01**	**8.22E+00**	

SLCRS:
2HVS*RQI-109B:

	SAE	GE	
LOCA Gap	3.70E-01	3.70E+00	TEDE
	8.13E-02	8.13E-01	THYROID
DBA LOCA	4.20E-01	4.20E+00	TEDE
	1.19E-01	1.19E+00	THYROID
LOCA RCS	3.29E+00	3.29E+01	TEDE
	9.09E-01	9.09E+00	THYROID
LOCA TID	1.27E-01	1.27E+00	TEDE
	1.27E-01	1.27E+00	THYROID
SB LOCA	3.07E-01	3.07E+00	TEDE
	1.54E-01	1.54E+00	THYROID
FHA	1.34E+00	1.34E+01	TEDE
	3.18E+00	3.18E+01	THYROID
RCCA	6.38E-01	6.38E+00	TEDE
	1.76E+00	1.76E+01	THYROID
Minimum Value =	**8.13E-02**	**8.13E-01**	

2HVS*RQI-109C:

	SAE	GE	
LOCA Gap	3.31E-01	3.31E+00	TEDE
	7.26E-02	7.26E-01	THYROID
DBA LOCA	3.83E-01	3.83E+00	TEDE
	1.08E-01	1.08E+00	THYROID
LOCA RCS	1.59E+00	1.59E+01	TEDE
	4.40E-01	4.40E+00	THYROID
LOCA TID	2.37E-01	2.37E+00	TEDE
	2.36E-01	2.36E+00	THYROID
SB LOCA	2.76E-01	2.76E+00	TEDE
	1.39E-01	1.39E+00	THYROID
FHA	1.12E+00	1.12E+01	TEDE
	2.65E+00	2.65E+01	THYROID
RCCA	5.78E-01	5.78E+00	TEDE
	1.60E+00	1.60E+01	THYROID
Minimum Value =	**7.26E-02**	**7.26E-01**	

2HVS*RQI-109E:

	SAE	GE	
Minimum Value =	**1.95E+06**	**1.95E+07**	

Calculation Summary (continued):

SLCRS (continued):
2HVS*RQI-109D:

	SAE	GE	
LOCA Gap	2.94E-01	2.94E+00	TEDE
	6.45E-02	6.45E-01	THYROID
DBA LOCA	3.39E-01	3.39E+00	TEDE
	9.62E-02	9.62E-01	THYROID
LOCA RCS	1.47E+00	1.47E+01	TEDE
	4.07E-01	4.07E+00	THYROID
LOCA TID	2.29E-01	2.29E+00	TEDE
	2.27E-01	2.27E+00	THYROID
SB LOCA	2.53E-01	2.53E+00	TEDE
	1.27E-01	1.27E+00	THYROID
FHA	9.73E-01	9.73E+00	TEDE
	2.31E+00	2.31E+01	THYROID
RCCA	5.14E-01	5.14E+00	TEDE
	1.42E+00	1.42E+01	THYROID
Minimum Value =	**6.45E-02**	**6.45E-01**	

Decon Building:
2RMQ-RQI-301B:

	SAE	GE	
LOCA RCS	1.91E+01	1.91E+02	TEDE
	5.28E+00	5.28E+01	THYROID
Minimum Value =	**5.28E+00**	**5.28E+01**	

Waste Gas Decay Tank Vault Vent:
2RMQ-RQI-303B:

	SAE	GE	
GWS	2.05E+01	2.05E+02	TEDE
	n/a	n/a	THYROID
Minimum Value =	**2.05E+01**	**2.05E+02**	

Main Steam:
2MSS*RQI-101A,B,C

	SAE	GE	
SGTR	2.06E+00	2.06E+01	TEDE
	5.10E-01	5.10E+00	THYROID
Minimum Value =	**5.10E-01**	**5.10E+00**	
2MSS*RQI-101A,B,C EFF			
Minimum Value =	**1.47E+06**	**1.47E+07**	

2HVS-RQI-101 Ventilation Vent:

Monitor efficiencies from ERS-SFL-86-026 | Upstream filtration (Iodines reduced 0.01) | X/Q = 1.03E-04 s/m^3
2HVS-RQI-101B | Release Flow Rate = 2.37E+04 cfm : 1.12E+07 cc/s
Release (uCi/s) CF for TEDE = 1.17E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 5.16E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.37E+02	2.12E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E+01	9.32E-07	0.00E+00	0.00E+00
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	5.82E+02	5.20E-05	3.20E+07	1.66E+03	0.00E+00	0.00E+00	2.56E+01	2.29E-06	3.20E+07	7.31E+01
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.34E+03	2.99E-04	3.60E+07	1.08E+04	0.00E+00	0.00E+00	1.47E+02	1.31E-05	3.60E+07	4.73E+02
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.22E+02	1.99E-05	3.73E+07	7.42E+02	0.00E+00	0.00E+00	9.78E+00	8.74E-07	3.73E+07	3.26E+01
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	9.43E+02	8.43E-05	3.05E+07	2.57E+03	0.00E+00	0.00E+00	4.14E+01	3.70E-06	3.05E+07	1.13E+02
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	1.97E-01	1.77E-08	3.72E+07	6.57E-01	0.00E+00	0.00E+00	8.68E-03	7.76E-10	3.72E+07	2.88E-02
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	1.91E+03	1.71E-04	2.44E+07	4.17E+03	0.00E+00	0.00E+00	8.40E+01	7.51E-06	2.44E+07	1.83E+02
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.67E+03	1.49E-04	2.86E+07	4.26E+03	0.00E+00	0.00E+00	7.32E+01	6.55E-06	2.86E+07	1.87E+02
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	9.79E+04	8.76E-03	1.80E+07	1.58E+05	0.00E+00	0.00E+00	4.30E+03	3.85E-04	1.80E+07	6.92E+03
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.26E+03	2.92E-04	7.22E+06	2.11E+03	0.00E+00	0.00E+00	1.43E+02	1.28E-05	7.22E+06	9.25E+01
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.14E+03	6.38E-04	3.86E+07	2.46E+04	0.00E+00	0.00E+00	3.14E+02	2.80E-05	3.86E+07	1.08E+03
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	6.71E-01	6.00E-08	3.78E+07	2.27E+00	0.00E+00	0.00E+00	2.95E-02	2.64E-09	3.78E+07	9.96E-02
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.05E+01	1.84E-06	3.52E+07	6.47E+01	0.00E+00	0.00E+00	9.02E-01	8.07E-08	3.52E+07	2.84E+00
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	7.19E+01	6.43E-06	2.98E+05	1.91E+00	2.44E+07	1.49E+04	3.16E+00	2.82E-07	2.98E+05	8.40E-02
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.48E+01	3.11E-06	3.72E+05	1.16E+00	2.90E+05	8.58E+01	1.53E+00	1.37E-07	3.72E+05	5.08E-02
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	2.79E+01	2.49E-06	3.69E+05	9.19E-01	5.77E+06	1.37E+03	1.23E+00	1.10E-07	3.69E+05	4.04E-02
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.71E+00	1.53E-07	3.78E+05	5.78E-02	7.60E+04	1.11E+00	7.53E-02	6.73E-09	3.78E+05	2.54E-03
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	8.90E+00	7.96E-07	3.49E+05	2.77E-01	1.19E+06	9.02E+01	3.91E-01	3.50E-08	3.49E+05	1.22E-02
	4.46E+04			7.24E+02				2.09E+05		1.65E+04		4.61E-04		9.16E+03

Monitor conversion factor CF11 (uCi/cc-cpm) = 3.65E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
7.61E-01	1.00E+02	2.09E+07	1.67E-01	5.00E+02	4.58E+06
3.81E-01	5.00E+01	1.04E+07	8.36E-02	2.50E+02	2.29E+06
7.61E+00	1.00E+03	2.09E+08	1.67E+00	5.00E+03	4.58E+07

Monitor efficiencies from ERS-SFL-86-026 | Upstream filtration (Iodines reduced 0.01) | X/Q = 1.03E-04 s/m^3
2HVS-RQI-101B | Release Flow Rate = 2.37E+04 cfm : 1.12E+07 cc/s
Release (uCi/s) CF for TEDE = 1.36E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 7.70E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	2.78E+02	2.49E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E+01	1.41E-06	0.00E+00	0.00E+00
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	6.82E+02	6.09E-05	3.20E+07	1.95E+03	0.00E+00	0.00E+00	3.87E+01	3.46E-06	3.20E+07	1.11E+02
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	1.96E+03	1.76E-04	3.60E+07	6.32E+03	0.00E+00	0.00E+00	1.11E+02	9.95E-06	3.60E+07	3.58E+02
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.61E+02	2.34E-05	3.73E+07	8.71E+02	0.00E+00	0.00E+00	1.48E+01	1.32E-06	3.73E+07	4.94E+01
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.11E+03	9.89E-05	3.05E+07	3.02E+03	0.00E+00	0.00E+00	6.28E+01	5.61E-06	3.05E+07	1.71E+02
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.32E-01	2.07E-08	3.72E+07	7.71E-01	0.00E+00	0.00E+00	1.31E-02	1.18E-09	3.72E+07	4.37E-02
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.24E+03	2.00E-04	2.44E+07	4.90E+03	0.00E+00	0.00E+00	1.27E+02	1.14E-05	2.44E+07	2.78E+02
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	1.96E+03	1.76E-04	2.86E+07	5.02E+03	0.00E+00	0.00E+00	1.11E+02	9.95E-06	2.86E+07	2.85E+02
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.15E+05	1.03E-02	1.80E+07	1.85E+05	0.00E+00	0.00E+00	6.51E+03	5.82E-04	1.80E+07	1.05E+04
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	3.83E+03	3.43E-04	7.22E+06	2.47E+03	0.00E+00	0.00E+00	2.17E+02	1.94E-05	7.22E+06	1.40E+02
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	8.38E+03	7.49E-04	3.86E+07	2.89E+04	0.00E+00	0.00E+00	4.75E+02	4.25E-05	3.86E+07	1.64E+03
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	7.87E-01	7.03E-08	3.78E+07	2.66E+00	0.00E+00	0.00E+00	4.46E-02	3.99E-09	3.78E+07	1.51E-01
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.41E+01	2.16E-06	3.52E+07	7.59E+01	0.00E+00	0.00E+00	1.37E+00	1.22E-07	3.52E+07	4.31E+00
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.27E+01	4.71E-06	2.98E+05	1.40E+00	2.44E+07	9.48E+03	2.99E+00	2.67E-07	2.98E+05	7.95E-02
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.08E+01	3.65E-06	3.72E+05	1.36E+00	2.90E+05	8.72E+01	2.31E+00	2.07E-07	3.72E+05	7.69E-02
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.28E+01	2.93E-06	3.69E+05	1.08E+00	5.77E+06	1.39E+03	1.86E+00	1.66E-07	3.69E+05	8.12E-02
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.01E+00	1.80E-07	3.78E+05	6.78E-02	7.60E+04	1.13E+00	1.14E-01	1.02E-08	3.78E+05	3.85E-03
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.04E+01	9.33E-07	3.49E+05	3.25E-01	1.19E+06	9.15E+01	5.92E-01	5.29E-08	3.49E+05	1.84E-02
	8.78E+05			6.27E+02				2.38E+05		1.10E+04		6.88E-04		1.35E+04

Monitor conversion factor CF11 (uCi/cc-cpm) = 3.65E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
8.70E-01	1.00E+02	2.38E+07	2.47E-01	5.00E+02	6.76E+06
4.35E-01	5.00E+01	1.19E+07	1.23E-01	2.50E+02	3.38E+06
8.70E+00	1.00E+03	2.38E+08	2.47E+00	5.00E+03	6.76E+07

2HVS-RQI-101 Ventilation Vent (cont.):

Monitor efficiencies from ERS-SFL-86-026 Upstream filtration (iodines reduced 0.01)
2HVS-RQI-101B Release Flow Rate = 2.37E+04 cfm ; 1.12E+07 cc/s
X/Q = 1.03E-04 s/m^3
Release (uCi/s) CF for TEDE = 6.41E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.54E+04 (Expression 5)

Isotope	U2 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.46E+01	1.30E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.06E-01	7.20E-08	0.00E+00	0.00E+00
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.02E+01	5.38E-06	3.20E+07	1.72E+02	0.00E+00	0.00E+00	3.32E+00	2.97E-07	3.20E+07	9.51E+00
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.56E+05	3.18E-02	3.60E+07	1.15E+06	0.00E+00	0.00E+00	1.97E+04	1.76E-03	3.60E+07	6.33E+04
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	7.66E+00	6.85E-07	3.73E+07	2.55E+01	0.00E+00	0.00E+00	4.23E-01	3.78E-08	3.73E+07	1.41E+00
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	6.55E+01	5.86E-06	3.05E+07	1.79E+02	0.00E+00	0.00E+00	3.62E+00	3.24E-07	3.05E+07	9.88E+00
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.18E-04	2.84E-11	3.72E+07	1.06E-03	0.00E+00	0.00E+00	1.76E-05	1.57E-12	3.72E+07	5.84E-05
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.28E+04	1.15E-03	2.44E+07	2.80E+04	0.00E+00	0.00E+00	7.09E+02	6.34E-05	2.44E+07	1.55E+03
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	1.97E+03	1.76E-04	2.86E+07	5.04E+03	0.00E+00	0.00E+00	1.09E+02	9.73E-06	2.86E+07	2.78E+02
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	2.70E+05	2.41E-02	1.80E+07	4.34E+05	0.00E+00	0.00E+00	1.49E+04	1.33E-03	1.80E+07	2.40E+04
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.32E+02	1.18E-05	7.22E+06	8.49E+01	0.00E+00	0.00E+00	7.27E+00	6.50E-07	7.22E+06	4.69E+00
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.02E+02	1.81E-05	3.86E+07	6.97E+02	0.00E+00	0.00E+00	1.12E+01	1.00E-06	3.86E+07	3.85E+01
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.29E-03	1.16E-10	3.78E+07	4.37E-03	0.00E+00	0.00E+00	7.15E-05	6.40E-12	3.78E+07	2.42E-04
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.44E-01	1.28E-08	3.52E+07	4.52E-01	0.00E+00	0.00E+00	7.94E-03	7.09E-10	3.52E+07	2.50E-02
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	5.89E+01	5.26E-06	2.98E+05	1.57E+00	2.44E+07	2.24E+03	3.25E+00	2.91E-07	2.98E+05	8.65E-02
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	3.94E+01	3.52E-06	3.72E+05	1.31E+00	2.90E+05	1.78E+01	2.18E+00	1.95E-07	3.72E+05	7.24E-02
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.50E+01	1.34E-06	3.69E+05	4.95E-01	5.77E+06	1.35E+02	8.30E-01	7.42E-08	3.69E+05	2.73E-02
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	3.93E-01	3.51E-08	3.78E+05	1.33E-02	7.60E+04	4.66E-02	2.17E-02	1.94E-09	3.78E+05	7.32E-04
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.09E+00	3.66E-07	3.49E+05	1.27E-01	1.19E+06	7.59E+00	2.26E-01	2.02E-08	3.49E+05	7.04E-03
	5.89E+01			1.33E+02				1.61E+06		2.40E+03		3.17E-03		6.91E+04

Monitor conversion factor CF11 (uCi/cc-cpm) = 3.65E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
5.89E+00	1.00E+02	1.61E+08	1.63E+00	5.00E+02	4.46E+07
2.94E+00	5.00E+01	8.07E+07	8.13E-01	2.50E+02	2.23E+07
5.89E+01	1.00E+03	1.61E+09	1.63E+01	5.00E+03	4.46E+08

Monitor efficiencies from ERS-SFL-86-026 Upstream filtration (iodines reduced 0.01)
2HVS-RQI-101B Release Flow Rate = 2.37E+04 cfm : 1.12E+07 cc/s
X/Q = 1.03E-04 s/m^3
Release (uCi/s) CF for TEDE = 2.03E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 4.04E+03 (Expression 5)

Isotope	U1 & U2 LOCA TID (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.65E+02	2.37E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.28E+01	4.72E-06	0.00E+00	0.00E+00
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	5.47E+02	4.89E-05	3.20E+07	1.56E+03	0.00E+00	0.00E+00	1.09E+02	9.73E-06	3.20E+07	3.11E+02
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.32E+01	2.07E-06	3.60E+07	7.46E+01	0.00E+00	0.00E+00	4.61E+00	4.12E-07	3.60E+07	1.48E+01
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.10E+03	9.80E-05	3.73E+07	3.66E+03	0.00E+00	0.00E+00	2.18E+02	1.95E-05	3.73E+07	7.27E+02
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.52E+03	1.36E-04	3.05E+07	4.16E+03	0.00E+00	0.00E+00	3.03E+02	2.71E-05	3.05E+07	8.27E+02
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	1.89E+03	1.69E-04	3.72E+07	6.29E+03	0.00E+00	0.00E+00	3.77E+02	3.37E-05	3.72E+07	1.25E+03
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.03E+01	2.71E-06	2.44E+07	6.61E+01	0.00E+00	0.00E+00	6.03E+00	5.39E-07	2.44E+07	1.32E+01
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.42E+02	1.27E-05	2.86E+07	3.62E+02	0.00E+00	0.00E+00	2.82E+01	2.52E-06	2.86E+07	7.20E+01
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	4.49E+03	4.01E-04	1.80E+07	7.22E+03	0.00E+00	0.00E+00	8.93E+02	7.98E-05	1.80E+07	1.44E+03
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	9.42E+02	8.42E-05	7.22E+06	6.08E+02	0.00E+00	0.00E+00	1.87E+02	1.68E-05	7.22E+06	1.21E+02
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.36E+03	1.21E-04	3.86E+07	4.68E+03	0.00E+00	0.00E+00	2.70E+02	2.41E-05	3.86E+07	9.31E+02
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.09E+03	3.66E-04	3.78E+07	1.38E+04	0.00E+00	0.00E+00	8.15E+02	7.28E-05	3.78E+07	2.75E+03
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	3.81E+03	3.41E-04	3.52E+07	1.20E+04	0.00E+00	0.00E+00	7.59E+02	6.78E-05	3.52E+07	2.39E+03
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.09E+01	9.75E-07	2.98E+05	2.90E-01	2.44E+07	1.31E+04	2.17E+00	1.94E-07	2.98E+05	5.77E-02
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.60E+01	1.43E-06	3.72E+05	5.31E-01	2.90E+05	2.28E+02	3.18E+00	2.84E-07	3.72E+05	1.06E-01
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.24E+01	2.01E-06	3.69E+05	7.39E-01	5.77E+06	6.37E+03	4.46E+00	3.99E-07	3.69E+05	1.47E-01
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.48E+01	2.22E-06	3.78E+05	8.38E-01	7.60E+04	9.29E+01	4.94E+00	4.41E-07	3.78E+05	1.67E-01
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.13E+01	1.91E-06	3.49E+05	6.64E-01	1.19E+06	1.25E+03	4.24E+00	3.79E-07	3.49E+05	1.32E-01
	7.24E+08			4.19E+03				5.45E+04		2.10E+04		3.61E-04		1.08E+04

Monitor conversion factor CF11 (uCi/cc-cpm) = 3.65E-08

uCi/cc	TEDE	*cpm*	*uCi/cc*	Child Thyroid	*cpm*
1.99E-01	1.00E+02	5.45E+06	1.98E-01	5.00E+02	5.42E+06
9.95E-02	5.00E+01	2.73E+06	9.90E-02	2.50E+02	2.71E+06
1.99E+00	1.00E+03	5.45E+07	1.98E+00	5.00E+03	5.42E+07

2HVS-RQI-101 Ventilation Vent (cont.):

Monitor efficiencies from ERS-SFL-86-026 — Upstream filtration (Iodines reduced 0.01)

2HVS-RQI-101B — Release Flow Rate = 2.37E+04 cfm : 1.12E+07 cc/s

X/Q = 1.03E-04 s/m³

Release (uCi/s) CF for TEDE = 9.40E+04 (Expression 5)

Release (uCi/s) CF for Child Thyroid = 9.45E+03 (Expression 5)

Isotope	U2 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.81E-04	5.84E+01	5.22E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.87E+00	5.25E-07	0.00E+00	0.00E+00
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.09E+02	1.87E-05	3.20E+07	5.97E+02	0.00E+00	0.00E+00	2.10E+01	1.88E-06	3.20E+07	6.00E+01
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	1.85E+04	1.66E-03	3.60E+07	5.96E+04	0.00E+00	0.00E+00	1.86E+03	1.67E-04	3.60E+07	5.99E+03
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.32E+02	1.18E-05	3.73E+07	4.41E+02	0.00E+00	0.00E+00	1.33E+01	1.19E-06	3.73E+07	4.43E+01
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	3.85E+02	3.44E-05	3.05E+07	1.05E+03	0.00E+00	0.00E+00	3.87E+01	3.46E-06	3.05E+07	1.06E+02
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.38E+00	3.02E-07	3.72E+07	1.12E+01	0.00E+00	0.00E+00	3.40E-01	3.03E-08	3.72E+07	1.13E+00
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	7.88E+02	7.05E-05	2.44E+07	1.72E+03	0.00E+00	0.00E+00	7.92E+01	7.08E-06	2.44E+07	1.73E+02
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.06E+02	6.31E-05	2.86E+07	1.81E+03	0.00E+00	0.00E+00	7.10E+01	6.34E-06	2.86E+07	1.81E+02
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	4.74E+04	4.24E-03	1.80E+07	7.62E+04	0.00E+00	0.00E+00	4.76E+03	4.26E-04	1.80E+07	7.66E+03
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.09E+04	1.87E-03	7.22E+06	1.35E+04	0.00E+00	0.00E+00	2.10E+03	1.88E-04	7.22E+06	1.36E+03
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	4.69E+03	4.19E-04	3.86E+07	1.62E+04	0.00E+00	0.00E+00	4.72E+02	4.22E-05	3.86E+07	1.62E+03
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.02E+01	9.14E-07	3.78E+07	3.45E+01	0.00E+00	0.00E+00	1.03E+00	9.19E-08	3.78E+07	3.47E+00
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.11E+01	6.35E-06	3.52E+07	2.24E+02	0.00E+00	0.00E+00	7.14E+00	6.39E-07	3.52E+07	2.25E+01
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.33E+01	2.08E-06	2.98E+05	8.19E-01	2.44E+07	6.04E+03	2.34E+00	2.09E-07	2.98E+05	8.22E-02
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.39E+01	2.14E-06	3.72E+05	7.95E-01	2.90E+05	7.38E+01	2.40E+00	2.15E-07	3.72E+05	7.99E-02
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.03E+01	3.61E-06	3.69E+05	1.33E+00	5.77E+06	2.48E+03	4.06E+00	3.63E-07	3.69E+05	1.34E-01
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	2.77E+01	2.47E-06	3.78E+05	9.34E-01	7.60E+04	2.24E+01	2.78E+00	2.49E-07	3.78E+05	9.39E-02
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.07E+01	2.75E-06	3.49E+05	9.57E-01	1.19E+06	3.89E+02	3.09E+00	2.76E-07	3.49E+05	9.62E-02
	4.01E+02			9.05E+02				1.71E+05		9.00E+03		8.45E-04		1.72E+04

Monitor conversion factor CF11 (uCi/cc-cpm) = 3.65E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
6.26E-01	1.00E+02	1.71E+07	3.14E-01	5.00E+02	8.61E+06
3.13E-01	5.00E+01	8.57E+06	1.57E-01	2.50E+02	4.31E+06
6.26E+00	1.00E+03	1.71E+08	3.14E+00	5.00E+03	8.61E+07

Monitor efficiencies from ERS-SFL-86-026 — Upstream filtration (Iodines reduced 0.01)

2HVS-RQI-101B — Release Flow Rate = 2.37E+04 cfm : 1.12E+07 cc/s

X/Q = 1.03E-04 s/m³

Release (uCi/s) CF for TEDE = 4.70E+05 (Expression 5)

Release (uCi/s) CF for Child Thyroid = 2.23E+05 (Expression 5)

Isotope	U1 & U2 FHA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	4.69E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85m	1.04E-03	3.07E-08	8.17E+02	2.50E-05	1.44E-02	1.29E-09	3.20E+07	4.12E-02	0.00E+00	0.00E+00	6.83E-03	6.10E-10	3.20E+07	1.95E-02
Kr-85	4.78E+02	1.41E-02	1.12E+01	1.58E-01	6.62E+03	5.92E-04	3.60E+07	2.13E+04	0.00E+00	0.00E+00	3.14E+03	2.81E-04	3.60E+07	1.01E+04
Kr-87	0.00E+00	0.00E+00	4.47E+03	0.00E+00	0.00E+00	0.00E+00	3.73E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.73E+07	0.00E+00
Kr-88	0.00E+00	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	3.05E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.05E+07	0.00E+00
Kr-89	0.00E+00	0.00E+00	1.02E+04	0.00E+00	0.00E+00	0.00E+00	3.72E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.72E+07	0.00E+00
Xe-131m	4.66E+02	1.37E-02	4.29E+01	5.89E-01	6.45E+03	5.77E-04	2.44E+07	1.41E+04	0.00E+00	0.00E+00	3.06E+03	2.73E-04	2.44E+07	6.68E+03
Xe-133m	6.16E+02	1.82E-02	1.49E+02	2.71E+00	8.53E+03	7.63E-04	2.86E+07	2.18E+04	0.00E+00	0.00E+00	4.04E+03	3.62E-04	2.86E+07	1.03E+04
Xe-133	3.23E+04	9.52E-01	1.76E+02	1.68E+02	4.47E+05	4.00E-02	1.80E+07	7.20E+05	0.00E+00	0.00E+00	2.12E+05	1.90E-02	1.80E+07	3.41E+05
Xe-135m	2.65E+00	7.81E-05	2.15E+03	1.68E-01	3.67E+01	3.28E-06	7.22E+06	2.37E+01	0.00E+00	0.00E+00	1.74E+01	1.56E-06	7.22E+06	1.12E+01
Xe-135	6.10E+01	1.80E-03	1.25E+03	2.25E+00	8.45E+02	7.55E-05	3.86E+07	2.91E+03	0.00E+00	0.00E+00	4.00E+02	3.58E-05	3.86E+07	1.38E+03
Xe-137	0.00E+00	0.00E+00	9.55E+02	0.00E+00	0.00E+00	0.00E+00	3.78E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.78E+07	0.00E+00
Xe-138	0.00E+00	0.00E+00	6.27E+03	0.00E+00	0.00E+00	0.00E+00	3.52E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.52E+07	0.00E+00
I-131	5.20E-01	1.53E-05	4.66E+05	7.14E+00	7.20E+00	6.44E-07	2.98E+05	1.92E-01	2.44E+07	3.74E+02	3.41E+00	3.05E-07	2.98E+05	9.08E-02
I-132	2.52E-01	7.43E-06	4.33E+04	3.22E-01	3.49E+00	3.12E-07	3.72E+05	1.16E-01	2.90E+05	2.15E+00	1.65E+00	1.48E-07	3.72E+05	5.50E-02
I-133	3.35E-02	9.87E-07	1.28E+05	1.28E-01	4.64E-01	4.15E-08	3.69E+05	1.53E-02	5.77E+06	5.70E+00	2.20E-01	1.97E-08	3.69E+05	7.25E-03
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	3.78E+05	0.00E+00	7.60E+04	0.00E+00	0.00E+00	0.00E+00	3.78E+05	0.00E+00
I-135	2.23E-05	6.57E-10	7.10E+04	4.67E-05	3.09E-04	2.76E-11	3.49E+05	9.62E-06	1.19E+06	7.82E-04	1.46E-04	1.31E-11	3.49E+05	4.56E-06
	3.39E+04			1.81E+02				7.80E+05		3.82E+02		1.99E-02		3.70E+05

Monitor conversion factor CF11 (uCi/cc-cpm) = 3.65E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
2.85E+00	1.00E+02	7.80E+07	6.75E+00	5.00E+02	1.85E+08
1.42E+00	5.00E+01	3.90E+07	3.37E+00	2.50E+02	9.24E+07
2.85E+01	1.00E+03	7.80E+08	6.75E+01	5.00E+03	1.85E+09

2HVS-RQI-101 Ventilation Vent (cont.):

Monitor efficiencies from ERS-SFL-88-026
2HVS-RQI-101B

Upstream filtration (Iodines reduced 0.01)
Release Flow Rate = 2.37E+04 cfm : 1.12E+07 cc/s

X/Q = 1.03E-04 s/m³
Release (uCi/s) CF for TEDE = 1.98E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.09E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	4.89E+02	4.37E-05	0.00E+00	0.00E+00
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.17E+03	1.04E-04	3.20E+07	3.34E+03
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	2.84E+03	2.54E-04	3.60E+07	9.15E+03
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	6.68E+02	5.97E-05	3.73E+07	2.23E+03
Kr-88	1.63E+02	1.08E-02	1.13E+04	1.19E+02	2.09E+03	1.87E-04	3.05E+07	5.70E+03
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	4.81E+01	4.30E-06	3.72E+07	1.60E+02
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.38E+03	2.13E-04	2.44E+07	5.20E+03
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	2.86E+03	2.55E-04	2.86E+07	7.30E+03
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.69E+05	1.51E-02	1.80E+07	2.72E+05
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	1.82E+03	1.63E-04	7.22E+06	1.17E+03
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.36E+04	1.21E-03	3.86E+07	4.68E+04
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.24E+02	1.11E-05	3.78E+07	4.19E+02
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.33E+02	3.87E-05	3.52E+07	1.36E+03
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	5.80E+00	5.18E-07	2.98E+05	1.54E-01
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.00E-01	1.79E-08	3.72E+05	6.64E-03
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	1.98E+00	1.77E-07	3.69E+05	6.54E-02
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.19E-01	1.06E-08	3.78E+05	4.01E-03
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	7.43E-01	6.64E-08	3.49E+05	2.31E-02
	1.54E+04			4.31E+02				3.55E+05

Isotope	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	2.70E+02	2.42E-05	0.00E+00	0.00E+00
Kr-85m	0.00E+00	0.00E+00	6.45E+02	5.77E-05	3.20E+07	1.85E+03
Kr-85	0.00E+00	0.00E+00	1.57E+03	1.40E-04	3.60E+07	5.05E+03
Kr-87	0.00E+00	0.00E+00	3.69E+02	3.30E-05	3.73E+07	1.23E+03
Kr-88	0.00E+00	0.00E+00	1.15E+03	1.03E-04	3.05E+07	3.15E+03
Kr-89	0.00E+00	0.00E+00	2.66E+01	2.38E-06	3.72E+07	8.84E+01
Xe-131m	0.00E+00	0.00E+00	1.32E+03	1.18E-04	2.44E+07	2.87E+03
Xe-133m	0.00E+00	0.00E+00	1.58E+03	1.41E-04	2.86E+07	4.03E+03
Xe-133	0.00E+00	0.00E+00	9.34E+04	8.35E-03	1.80E+07	1.50E+05
Xe-135m	0.00E+00	0.00E+00	1.00E+03	8.98E-05	7.22E+06	6.48E+02
Xe-135	0.00E+00	0.00E+00	7.50E+03	6.70E-04	3.86E+07	2.58E+04
Xe-137	0.00E+00	0.00E+00	6.85E+01	6.12E-06	3.78E+07	2.31E+02
Xe-138	0.00E+00	0.00E+00	2.39E+02	2.14E-05	3.52E+07	7.53E+02
I-131	2.44E+07	7.17E+02	3.20E+00	2.86E-07	2.98E+05	8.52E-02
I-132	2.90E+05	2.93E-01	1.10E-01	9.87E-09	3.72E+05	3.67E-03
I-133	5.77E+06	5.80E+01	1.10E+00	9.80E-08	3.69E+05	3.61E-02
I-134	7.60E+04	4.58E-02	6.57E-02	5.88E-09	3.78E+05	2.22E-03
I-135	1.19E+06	4.47E+00	4.10E-01	3.67E-08	3.49E+05	1.28E-02
		7.79E+02		9.76E-03		1.96E+05

Monitor conversion factor CF11 (uCi/cc-cpm) = 3.65E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
1.29E+00	1.00E+02	3.55E+07	3.58E+00	5.00E+02	9.80E+07
6.47E-01	5.00E+01	1.77E+07	1.79E+00	2.50E+02	4.90E+07
1.29E+01	1.00E+03	3.55E+08	3.58E+01	5.00E+03	9.80E+08

2HVS-RQI-112B Condensate Polishing Vent:

Monitor efficiencies from ERS-SFL-88-026 | Upstream filtration (Iodines reduced 0.01)

2HVS-RQI-112B | Release Flow Rate = 3.06E+04 cfm | 1.44E+07 cc/s

X/Q = 7.35E-05 s/m³

Release (uCi/s) CF for TEDE = 1.17E+05 (Expression 5)

Release (uCi/s) CF for Child Thyroid = 3.29E+05 (Expression 5)

Isotope	U2 only SGTR (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.87E+00	5.15E-04	4.69E-01	2.41E-04	6.01E+01	4.16E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E+02	1.17E-05	0.00E+00	0.00E+00
Kr-85m	8.78E+00	1.58E-03	8.17E+02	1.29E+00	1.84E+02	1.28E-05	3.20E+07	4.08E+02	0.00E+00	0.00E+00	5.19E+02	3.60E-05	3.20E+07	1.15E+03
Kr-85	8.29E+02	1.49E-01	1.12E+01	1.66E+00	1.73E+04	1.20E-03	3.60E+07	4.33E+04	0.00E+00	0.00E+00	4.89E+04	3.39E-03	3.60E+07	1.22E+05
Kr-87	4.91E+00	8.80E-04	4.47E+03	3.94E+00	1.03E+02	7.12E-06	3.73E+07	2.66E+02	0.00E+00	0.00E+00	2.90E+02	2.01E-05	3.73E+07	7.50E+02
Kr-88	1.57E+01	2.82E-03	1.13E+04	3.18E+01	3.28E+02	2.28E-05	3.05E+07	6.95E+02	0.00E+00	0.00E+00	9.27E+02	6.43E-05	3.05E+07	1.96E+03
Kr-89	5.20E-02	9.32E-06	1.02E+04	9.51E-02	1.09E+00	7.54E-08	3.72E+07	2.81E+00	0.00E+00	0.00E+00	3.07E+00	2.13E-07	3.72E+07	7.92E+00
Xe-131m	3.42E+01	6.13E-03	4.29E+01	2.63E-01	7.16E+02	4.96E-05	2.44E+07	1.21E+03	0.00E+00	0.00E+00	2.02E+03	1.40E-04	2.44E+07	3.42E+03
Xe-133m	3.25E+01	5.83E-03	1.49E+02	8.68E-01	6.80E+02	4.71E-05	2.86E+07	1.35E+03	0.00E+00	0.00E+00	1.92E+03	1.33E-04	2.86E+07	3.80E+03
Xe-133	2.13E+03	3.82E-01	1.76E+02	6.72E+01	4.46E+04	3.09E-03	1.80E+07	5.56E+04	0.00E+00	0.00E+00	1.26E+05	8.72E-03	1.80E+07	1.57E+05
Xe-135m	2.11E+03	3.78E-01	2.15E+03	8.13E+02	4.41E+04	3.06E-03	7.22E+06	2.21E+04	0.00E+00	0.00E+00	1.25E+05	8.64E-03	7.22E+06	6.23E+04
Xe-135	4.07E+02	7.30E-02	1.25E+03	9.12E+01	8.52E+03	5.90E-04	3.86E+07	2.28E+04	0.00E+00	0.00E+00	2.40E+04	1.67E-03	3.86E+07	6.42E+04
Xe-137	1.57E-01	2.82E-05	9.55E+02	2.69E-02	3.28E+00	2.28E-07	3.78E+07	8.61E+00	0.00E+00	0.00E+00	9.27E+00	6.43E-07	3.78E+07	2.43E+01
Xe-138	1.56E+00	2.80E-04	6.27E+03	1.75E+00	3.26E+01	2.26E-06	3.52E+07	7.97E+01	0.00E+00	0.00E+00	9.21E+01	6.38E-06	3.52E+07	2.25E+02
I-131	5.94E-02	1.07E-05	4.86E+05	4.96E+00	1.24E+00	8.62E-08	2.98E+05	2.56E-02	2.44E+07	2.60E+02	3.51E+00	2.43E-07	2.98E+05	7.23E-02
I-132	2.04E-02	3.66E-06	4.33E+04	1.58E-01	4.27E-01	2.96E-08	3.72E+05	1.10E-02	2.90E+05	1.06E+00	1.20E+00	8.35E-08	3.72E+05	3.11E-02
I-133	8.76E-02	1.57E-05	1.28E+05	2.01E+00	1.83E+00	1.27E-07	3.69E+05	4.68E-02	5.77E+06	9.06E+01	5.17E+00	3.59E-07	3.69E+05	1.32E-01
I-134	9.49E-03	1.70E-06	2.69E+04	4.56E-02	1.99E-01	1.38E-08	3.78E+05	5.20E-03	7.60E+04	1.29E-01	5.60E-01	3.88E-08	3.78E+05	1.47E-02
I-135	4.84E-02	8.68E-06	7.10E+04	6.16E-01	1.01E+00	7.02E-08	3.49E+05	2.45E-02	1.19E+06	1.03E+01	2.86E+00	1.98E-07	3.49E+05	6.90E-02
	5.58E+03			1.02E+03				1.48E+05		3.62E+02		2.28E-02		4.17E+05

Monitor conversion factor CF11 (uCi/cc-cpm) = 5.56E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
8.22E-01	1.00E+02	1.48E+07	1.16E+01	5.00E+02	2.08E+08
4.11E-01	5.00E+01	7.39E+06	5.80E+00	2.50E+02	1.04E+08
8.22E+00	1.00E+03	1.48E+08	1.16E+02	5.00E+03	2.08E+09

Iodines reduced by X100 for filtration

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

Subject:
BVPS-U2 Gaseous Radioactivity Monitor Emergency Action Levels

No.: **ERS-MPD-93-008 Attachment 3**

REVISION: 7

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2HVS*RQI-109B Low Range SLCRS:

Monitor efficiencies from ERS-SFL-88-026

2HVS*RQI-109B

Upstream filtration (iodines reduced 0.01)

Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³

Release (uCi/s) CF for TEDE = 1.31E+05 (Expression 5)

Release (uCi/s) CF for Child Thyroid = 5.75E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.64E+02	9.50E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E+01	4.17E-07	0.00E+00	0.00E+00
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	6.49E+02	2.33E-05	5.83E+07	1.36E+03	0.00E+00	0.00E+00	2.85E+01	1.02E-06	5.83E+07	5.97E+01
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.73E+03	1.34E-04	7.19E+07	9.62E+03	0.00E+00	0.00E+00	1.64E+02	5.88E-06	7.19E+07	4.23E+02
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.48E+02	8.91E-06	8.85E+07	7.88E+02	0.00E+00	0.00E+00	1.09E+01	3.91E-07	8.85E+07	3.46E+01
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	1.05E+03	3.77E-05	6.80E+07	2.57E+03	0.00E+00	0.00E+00	4.62E+01	1.66E-06	6.80E+07	1.13E+02
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	2.20E-01	7.90E-09	8.73E+07	6.90E-01	0.00E+00	0.00E+00	9.67E-03	3.47E-10	8.73E+07	3.03E-02
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	2.13E+03	7.65E-05	4.61E+04	3.53E+00	0.00E+00	0.00E+00	9.36E+01	3.36E-06	4.61E+04	1.55E-01
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.86E+03	6.67E-05	6.06E+04	4.04E+00	0.00E+00	0.00E+00	8.16E+01	2.93E-06	6.06E+04	1.78E-01
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	1.09E+05	3.92E-03	2.94E+07	1.15E+05	0.00E+00	0.00E+00	4.80E+03	1.72E-04	2.94E+07	5.06E+03
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.64E+03	1.31E-04	1.55E+04	2.02E+00	0.00E+00	0.00E+00	1.60E+02	5.74E-06	1.55E+04	8.89E-02
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.95E+03	2.86E-04	7.48E+07	2.13E+04	0.00E+00	0.00E+00	3.49E+02	1.25E-05	7.48E+07	9.38E+02
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	7.48E-01	2.69E-08	9.07E+07	2.44E+00	0.00E+00	0.00E+00	3.29E-02	1.18E-09	9.07E+07	1.07E-01
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.29E+01	8.22E-07	7.74E+07	6.36E+01	0.00E+00	0.00E+00	1.01E+00	3.61E-08	7.74E+07	2.79E+00
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	8.01E+01	2.88E-06	6.23E+05	1.79E+00	2.44E+07	1.49E+04	3.52E+00	1.26E-07	6.23E+05	7.88E-02
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.87E+01	1.39E-06	7.91E+05	1.10E+00	2.90E+05	8.58E+01	1.70E+00	6.11E-08	7.91E+05	4.84E-02
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	3.11E+01	1.12E-06	7.67E+05	8.57E-01	5.77E+06	1.37E+03	1.37E+00	4.91E-08	7.67E+05	3.76E-02
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.91E+00	6.86E-08	8.16E+05	5.60E-02	7.60E+04	1.11E+00	8.39E-02	3.01E-09	8.16E+05	2.46E-03
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	9.92E+00	3.56E-07	7.32E+05	2.61E-01	1.19E+06	9.02E+01	4.36E-01	1.57E-08	7.32E+05	1.15E-02
	4.46E+04			7.24E+02				1.51E+05		1.65E+04		2.07E-04		6.64E+03

Monitor conversion factor CF11 (uCi/cc-cpm) = 2.45E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
3.70E-01	1.00E+02	1.51E+07	8.13E-02	5.00E+02	3.32E+06
1.85E-01	5.00E+01	7.55E+06	4.06E-02	2.50E+02	1.66E+06
3.70E+00	1.00E+03	1.51E+08	8.13E-01	5.00E+03	3.32E+07

Monitor efficiencies from ERS-SFL-88-026

2HVS*RQI-109B

Upstream filtration (iodines reduced 0.01)

Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³

Release (uCi/s) CF for TEDE = 1.51E+05 (Expression 5)

Release (uCi/s) CF for Child Thyroid = 8.58E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	3.10E+02	1.11E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E+01	6.32E-07	0.00E+00	0.00E+00
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	7.60E+02	2.73E-05	5.83E+07	1.59E+03	0.00E+00	0.00E+00	4.31E+01	1.55E-06	5.83E+07	9.03E+01
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	2.19E+03	7.86E-05	7.19E+07	5.65E+03	0.00E+00	0.00E+00	1.24E+02	4.46E-06	7.19E+07	3.20E+02
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.91E+02	1.05E-05	8.85E+07	9.25E+02	0.00E+00	0.00E+00	1.65E+01	5.93E-07	8.85E+07	5.25E+01
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.23E+03	4.43E-05	6.80E+07	3.01E+03	0.00E+00	0.00E+00	7.00E+01	2.51E-06	6.80E+07	1.71E+02
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.58E-01	9.28E-09	8.73E+07	8.10E-01	0.00E+00	0.00E+00	1.47E-02	5.26E-10	8.73E+07	4.60E-02
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.50E+03	8.97E-05	4.61E+04	4.14E+00	0.00E+00	0.00E+00	1.42E+02	5.09E-06	4.61E+04	2.35E-01
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	2.19E+03	7.86E-05	6.06E+04	4.76E+00	0.00E+00	0.00E+00	1.24E+02	4.46E-06	6.06E+04	2.70E-01
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.28E+05	4.60E-03	2.94E+07	1.35E+05	0.00E+00	0.00E+00	7.26E+03	2.61E-04	2.94E+07	7.67E+03
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	4.27E+03	1.53E-04	1.55E+04	2.38E+00	0.00E+00	0.00E+00	2.42E+02	8.70E-06	1.55E+04	1.35E-01
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	9.34E+03	3.35E-04	7.48E+07	2.51E+04	0.00E+00	0.00E+00	5.30E+02	1.90E-05	7.48E+07	1.42E+03
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	8.77E-01	3.15E-08	9.07E+07	2.86E+00	0.00E+00	0.00E+00	4.97E-02	1.79E-09	9.07E+07	1.62E-01
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.69E+01	9.65E-07	7.74E+07	7.47E+01	0.00E+00	0.00E+00	1.52E+00	5.47E-08	7.74E+07	4.24E+00
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.88E+01	2.11E-06	6.23E+05	1.31E+00	2.44E+07	9.48E+03	3.33E+00	1.20E-07	6.23E+05	7.46E-02
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.55E+01	1.63E-06	7.91E+05	1.29E+00	2.90E+05	8.72E+01	2.58E+00	9.26E-08	7.91E+05	7.33E-02
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.65E+01	1.31E-06	7.67E+05	1.01E+00	5.77E+06	1.39E+03	2.07E+00	7.44E-08	7.67E+05	5.70E-02
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.24E+00	8.04E-08	8.16E+05	6.56E-02	7.60E+04	1.13E+00	1.27E-01	4.56E-09	8.16E+05	3.72E-03
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.16E+01	4.18E-07	7.32E+05	3.06E-01	1.19E+06	9.15E+01	6.60E-01	2.37E-08	7.32E+05	1.73E-02
	8.78E+05			6.27E+02				1.72E+05		1.10E+04		3.08E-04		9.73E+03

Monitor conversion factor CF11 (uCi/cc-cpm) = 2.45E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
4.20E-01	1.00E+02	1.72E+07	1.19E-01	5.00E+02	4.86E+06
2.10E-01	5.00E+01	8.58E+06	5.96E-02	2.50E+02	2.43E+06
4.20E+00	1.00E+03	1.72E+08	1.19E+00	5.00E+03	4.86E+07

2HVS*RQI-109B Low Range SLCRS (continued):

X/Q = 9.24E-05 s/m³

Monitor efficiencies from ERS-SFL-86-026 Upstream filtration (Iodines reduced 0.01) Release (uCi/s) CF for TEDE = 7.15E+05 (Expression 5)

2HVS*RQI-109B Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s Release (uCi/s) CF for Child Thyroid = 3.95E+04 (Expression 5)

Isotope	U2 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.83E+01	5.84E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.98E-01	3.22E-08	0.00E+00	0.00E+00
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.71E+01	2.41E-06	5.83E+07	1.41E+02	0.00E+00	0.00E+00	3.71E+00	1.33E-07	5.83E+07	7.76E+00
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.97E+05	1.42E-02	7.19E+07	1.02E+06	0.00E+00	0.00E+00	2.19E+04	7.87E-04	7.19E+07	5.66E+04
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	8.54E+00	3.07E-07	8.85E+07	2.71E+01	0.00E+00	0.00E+00	4.72E-01	1.69E-08	8.85E+07	1.50E+00
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	7.30E+01	2.62E-06	6.80E+07	1.78E+02	0.00E+00	0.00E+00	4.03E+00	1.45E-07	6.80E+07	9.86E+00
Kr-89	2.92E-08	4.95E-10	1.02E+04	5.06E-06	3.54E-04	1.27E-11	8.73E+07	1.11E-03	0.00E+00	0.00E+00	1.96E-05	7.03E-13	8.73E+07	6.14E-05
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.43E+04	5.14E-04	4.61E+04	2.37E+01	0.00E+00	0.00E+00	7.91E+02	2.84E-05	4.61E+04	1.31E+00
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	2.20E+03	7.88E-05	6.06E+04	4.78E+00	0.00E+00	0.00E+00	1.21E+02	4.36E-06	6.06E+04	2.64E-01
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	3.01E+05	1.08E-02	2.94E+07	3.18E+05	0.00E+00	0.00E+00	1.66E+04	5.97E-04	2.94E+07	1.75E+04
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.47E+02	5.27E-06	1.55E+04	8.16E-02	0.00E+00	0.00E+00	8.11E+00	2.91E-07	1.55E+04	4.51E-03
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.26E+02	8.10E-06	7.48E+07	6.06E+02	0.00E+00	0.00E+00	1.25E+01	4.48E-07	7.48E+07	3.35E+01
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.44E-03	5.18E-11	9.07E+07	4.70E-03	0.00E+00	0.00E+00	7.97E-05	2.86E-12	9.07E+07	2.60E-04
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.60E-01	5.75E-09	7.74E+07	4.45E-01	0.00E+00	0.00E+00	8.85E-03	3.18E-10	7.74E+07	2.46E-02
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	6.56E+01	2.36E-06	6.23E+05	1.47E+00	2.44E+07	2.24E+03	3.63E+00	1.30E-07	6.23E+05	8.11E-02
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	4.39E+01	1.58E-06	7.91E+05	1.25E+00	2.90E+05	1.78E+01	2.43E+00	8.71E-08	7.91E+05	6.89E-02
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.67E+01	6.01E-07	7.67E+05	4.61E-01	5.77E+06	1.35E+02	9.25E-01	3.32E-08	7.67E+05	2.55E-02
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	4.38E-01	1.57E-08	8.16E+05	1.28E-02	7.60E+04	4.66E-02	2.42E-02	8.69E-10	8.16E+05	7.09E-04
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.56E+00	1.64E-07	7.32E+05	1.20E-01	1.19E+06	7.59E+00	2.52E-01	9.05E-09	7.32E+05	6.62E-03
	5.89E+01			1.33E+02				1.34E+06		2.40E+03		1.42E-03		7.42E+04

Monitor conversion factor CF11 (uCi/cc-cpm) = 2.45E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
3.29E+00	1.00E+02	1.34E+08	9.09E-01	5.00E+02	3.71E+07
1.64E+00	5.00E+01	6.71E+07	4.54E-01	2.50E+02	1.85E+07
3.29E+01	1.00E+03	1.34E+09	9.09E+00	5.00E+03	3.71E+08

X/Q = 9.24E-05 s/m³

Monitor efficiencies from ERS-SFL-86-026 Upstream filtration (Iodines reduced 0.01) Release (uCi/s) CF for TEDE = 2.26E+04 (Expression 5)

2HVS*RQI-109B Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s Release (uCi/s) CF for Child Thyroid = 4.50E+03 (Expression 5)

Isotope	U1 & U2 LOCA TID (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.96E+02	1.06E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.88E+01	2.11E-06	0.00E+00	0.00E+00
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	6.10E+02	2.19E-05	5.83E+07	1.28E+03	0.00E+00	0.00E+00	1.21E+02	4.35E-06	5.83E+07	2.54E+02
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.59E+01	9.28E-07	7.19E+07	6.67E+01	0.00E+00	0.00E+00	5.14E+00	1.85E-07	7.19E+07	1.33E+01
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.22E+03	4.39E-05	8.85E+07	3.88E+03	0.00E+00	0.00E+00	2.43E+02	8.73E-06	8.85E+07	7.73E+02
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.70E+03	6.10E-05	6.80E+07	4.15E+03	0.00E+00	0.00E+00	3.38E+02	1.21E-05	6.80E+07	8.25E+02
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	2.11E+03	7.58E-05	8.73E+07	6.62E+03	0.00E+00	0.00E+00	4.20E+02	1.51E-05	8.73E+07	1.32E+03
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.38E+01	1.21E-06	4.61E+04	5.59E-02	0.00E+00	0.00E+00	6.72E+00	2.41E-07	4.61E+04	1.11E-02
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.58E+02	5.67E-06	6.06E+04	3.44E-01	0.00E+00	0.00E+00	3.14E+01	1.13E-06	6.06E+04	6.84E-02
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	5.00E+03	1.80E-04	2.94E+07	5.28E+03	0.00E+00	0.00E+00	9.95E+02	3.57E-05	2.94E+07	1.05E+03
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	1.05E+03	3.77E-05	1.55E+04	5.84E-01	0.00E+00	0.00E+00	2.09E+02	7.50E-06	1.55E+04	1.16E-01
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.51E+03	5.43E-05	7.48E+07	4.06E+03	0.00E+00	0.00E+00	3.01E+02	1.08E-05	7.48E+07	8.08E+02
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.56E+03	1.64E-04	9.07E+07	1.49E+04	0.00E+00	0.00E+00	9.08E+02	3.26E-05	9.07E+07	2.96E+03
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	4.25E+03	1.53E-04	7.74E+07	1.18E+04	0.00E+00	0.00E+00	8.46E+02	3.04E-05	7.74E+07	2.35E+03
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.22E+01	4.37E-07	6.23E+05	2.72E-01	2.44E+07	1.31E+04	2.42E+00	8.69E-08	6.23E+05	5.41E-02
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.78E+01	6.40E-07	7.91E+05	5.06E-01	2.90E+05	2.28E+02	3.54E+00	1.27E-07	7.91E+05	1.01E-01
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.50E+01	8.98E-07	7.67E+05	6.89E-01	5.77E+06	6.37E+03	4.98E+00	1.79E-07	7.67E+05	1.37E-01
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.77E+01	9.93E-07	8.16E+05	8.10E-01	7.60E+04	9.29E+01	5.50E+00	1.98E-07	8.16E+05	1.61E-01
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.38E+01	8.53E-07	7.32E+05	6.24E-01	1.19E+06	1.25E+03	4.73E+00	1.70E-07	7.32E+05	1.24E-01
	7.24E+08			4.19E+03				5.20E+04		2.10E+04		1.62E-04		1.03E+04

Monitor conversion factor CF11 (uCi/cc-cpm) = 2.45E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
1.27E-01	1.00E+02	5.20E+06	1.27E-01	5.00E+02	5.17E+06
6.37E-02	5.00E+01	2.60E+06	6.34E-02	2.50E+02	2.69E+06
1.27E+00	1.00E+03	5.20E+07	1.27E+00	5.00E+03	5.17E+07

2HVS*RQI-109B Low Range SLCRS (continued):

Monitor efficiencies from ERS-SFL-86-026 Upstream filtration (Iodines reduced 0.01)
2HVS*RQI-109B Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.05E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.05E+04 (Expression 5)

Isotope	U2 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	6.51E+01	2.34E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.54E+00	2.35E-07	0.00E+00	0.00E+00
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.33E+02	8.36E-06	5.83E+07	4.87E+02	0.00E+00	0.00E+00	2.34E+01	8.40E-07	5.83E+07	4.90E+01
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	2.07E+04	7.42E-04	7.19E+07	5.33E+04	0.00E+00	0.00E+00	2.08E+03	7.46E-05	7.19E+07	5.36E+03
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.47E+02	5.30E-06	8.85E+07	4.69E+02	0.00E+00	0.00E+00	1.48E+01	5.32E-07	8.85E+07	4.71E+01
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	4.20E+02	1.54E-05	6.80E+07	1.05E+03	0.00E+00	0.00E+00	4.31E+01	1.55E-06	6.80E+07	1.05E+02
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.77E+00	1.35E-07	8.73E+07	1.18E+01	0.00E+00	0.00E+00	3.78E-01	1.36E-08	8.73E+07	1.19E+00
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	8.79E+02	3.15E-05	4.61E+04	1.46E+00	0.00E+00	0.00E+00	8.83E+01	3.17E-06	4.61E+04	1.46E-01
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.87E+02	2.83E-05	6.06E+04	1.71E+00	0.00E+00	0.00E+00	7.91E+01	2.84E-06	6.06E+04	1.72E-01
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	5.28E+04	1.90E-03	2.94E+07	5.58E+04	0.00E+00	0.00E+00	5.31E+03	1.91E-04	2.94E+07	5.60E+03
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.33E+04	8.37E-04	1.55E+04	1.30E+01	0.00E+00	0.00E+00	2.34E+03	8.41E-05	1.55E+04	1.30E+00
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	5.23E+03	1.88E-04	7.48E+07	1.40E+04	0.00E+00	0.00E+00	5.26E+02	1.89E-05	7.48E+07	1.41E+03
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.14E+01	4.09E-07	9.07E+07	3.71E+01	0.00E+00	0.00E+00	1.15E+00	4.11E-08	9.07E+07	3.73E+00
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.92E+01	2.84E-06	7.74E+07	2.20E+02	0.00E+00	0.00E+00	7.96E+00	2.86E-07	7.74E+07	2.21E+01
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.59E+01	9.31E-07	6.23E+05	5.80E-01	2.44E+07	6.04E+03	2.61E+00	9.36E-08	6.23E+05	5.83E-02
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.67E+01	9.58E-07	7.91E+05	7.58E-01	2.90E+05	7.38E+01	2.68E+00	9.63E-08	7.91E+05	7.62E-02
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.50E+01	1.61E-06	7.67E+05	1.24E+00	5.77E+06	2.48E+03	4.52E+00	1.62E-07	7.67E+05	1.24E-01
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	3.09E+01	1.11E-06	8.16E+05	9.04E-01	7.60E+04	2.24E+01	3.10E+00	1.11E-07	8.16E+05	9.08E-02
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.43E+01	1.23E-06	7.32E+05	9.00E-01	1.19E+06	3.89E+02	3.44E+00	1.24E-07	7.32E+05	9.05E-02
	4.01E+02			9.05E+02				1.25E+05		9.00E+03		3.78E-04		1.26E+04

Monitor conversion factor CF11 (uCi/cc-cpm) = 2.45E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
3.07E-01	1.00E+02	1.26E+07	1.54E-01	5.00E+02	6.30E+06
1.54E-01	5.00E+01	6.27E+06	7.72E-02	2.50E+02	3.15E+06
3.07E+00	1.00E+03	1.25E+08	1.54E+00	5.00E+03	6.30E+07

Monitor efficiencies from ERS-SFL-86-026 Upstream filtration (Iodines reduced 0.01)
2HVS*RQI-109B Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 5.24E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.48E+05 (Expression 5)

Isotope	U1 & U2 FHA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	4.69E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85m	1.04E-03	3.07E-08	8.17E+02	2.50E-05	1.61E-02	5.77E-10	5.83E+07	3.36E-02	0.00E+00	0.00E+00	7.61E-03	2.73E-10	5.83E+07	1.59E-02
Kr-85	4.78E+02	1.41E-02	1.12E+01	1.58E-01	7.38E+03	2.65E-04	7.19E+07	1.91E+04	0.00E+00	0.00E+00	3.50E+03	1.26E-04	7.19E+07	9.03E+03
Kr-87	0.00E+00	0.00E+00	4.47E+03	0.00E+00	0.00E+00	0.00E+00	8.85E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.85E+07	0.00E+00
Kr-88	0.00E+00	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	6.80E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.80E+07	0.00E+00
Kr-89	0.00E+00	0.00E+00	1.02E+04	0.00E+00	0.00E+00	0.00E+00	8.73E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.73E+07	0.00E+00
Xe-131m	4.66E+02	1.37E-02	4.29E+01	5.89E-01	7.19E+03	2.58E-04	4.61E+04	1.19E+01	0.00E+00	0.00E+00	3.41E+03	1.22E-04	4.61E+04	5.65E+00
Xe-133m	6.16E+02	1.82E-02	1.49E+02	2.71E+00	9.51E+03	3.41E-04	6.06E+04	2.07E+01	0.00E+00	0.00E+00	4.51E+03	1.62E-04	6.06E+04	9.81E+00
Xe-133	3.23E+04	9.52E-01	1.76E+02	1.68E+02	4.99E+05	1.79E-02	2.94E+07	5.26E+05	0.00E+00	0.00E+00	2.36E+05	8.49E-03	2.94E+07	2.50E+05
Xe-135m	2.65E+00	7.81E-05	2.15E+03	1.68E-01	4.09E+01	1.47E-06	1.55E+04	2.28E-02	0.00E+00	0.00E+00	1.94E+01	6.96E-07	1.55E+04	1.08E-02
Xe-135	6.10E+01	1.80E-03	1.25E+03	2.25E+00	9.42E+02	3.38E-05	7.48E+07	2.53E+03	0.00E+00	0.00E+00	4.46E+02	1.60E-05	7.48E+07	1.20E+03
Xe-137	0.00E+00	0.00E+00	9.55E+02	0.00E+00	0.00E+00	0.00E+00	9.07E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.07E+07	0.00E+00
Xe-138	0.00E+00	0.00E+00	6.27E+03	0.00E+00	0.00E+00	0.00E+00	7.74E+07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.74E+07	0.00E+00
I-131	5.20E-01	1.53E-05	4.66E+05	7.14E+00	8.03E+00	2.88E-07	6.23E+05	1.80E-01	2.44E+07	3.74E+02	3.81E+00	1.37E-07	6.23E+05	8.52E-02
I-132	2.52E-01	7.43E-06	4.33E+04	3.22E-01	3.89E+00	1.40E-07	7.91E+05	1.11E-01	2.90E+05	2.15E+00	1.84E+00	6.62E-08	7.91E+05	5.24E-02
I-133	3.35E-02	9.87E-07	1.28E+05	1.26E-01	5.17E-01	1.86E-08	7.67E+05	1.42E-02	5.77E+06	5.70E+00	2.45E-01	8.80E-09	7.67E+05	6.75E-03
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	8.16E+05	0.00E+00	7.60E+04	0.00E+00	0.00E+00	0.00E+00	8.16E+05	0.00E+00
I-135	2.23E-05	6.57E-10	7.10E+04	4.67E-05	3.44E-04	1.24E-11	7.32E+05	9.05E-06	1.19E+06	7.82E-04	1.63E-04	5.86E-12	7.32E+05	4.29E-06
	3.39E+04			1.81E+02				5.48E+05		3.82E+02		8.92E-03		2.60E+05

Monitor conversion factor CF11 (uCi/cc-cpm) = 2.45E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
1.34E+00	1.00E+02	5.48E+07	3.18E+00	5.00E+02	1.30E+08
6.71E-01	5.00E+01	2.74E+07	1.59E+00	2.50E+02	6.50E+07
1.34E+01	1.00E+03	5.48E+08	3.18E+01	5.00E+03	1.30E+09

2HVS*RQI-109B Low Range SLCRS (continued):

Monitor efficiencies from ERS-SFL-86-026

2HVS*RQI-109B

Upstream filtration (Iodines reduced 0.01)

Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³

Release (uCi/s) CF for TEDE = 2.20E+05 (Expression 5)

Release (uCi/s) CF for Child Thyroid = 1.22E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	5.45E+02	1.96E-05	0.00E+00	0.00E+00
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.30E+03	4.67E-05	5.83E+07	2.73E+03
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	3.17E+03	1.14E-04	7.19E+07	8.18E+03
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	7.45E+02	2.68E-05	8.85E+07	2.37E+03
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.33E+03	8.35E-05	6.80E+07	5.68E+03
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	5.37E+01	1.93E-06	8.73E+07	1.68E+02
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.65E+03	9.53E-05	4.61E+04	4.40E+00
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	3.18E+03	1.14E-04	6.06E+04	6.93E+00
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.88E+05	6.77E-03	2.94E+07	1.99E+05
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	2.03E+03	7.28E-05	1.55E+04	1.13E+00
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.51E+04	5.43E-04	7.48E+07	4.06E+04
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.38E+02	4.96E-06	9.07E+07	4.50E+02
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.82E+02	1.73E-05	7.74E+07	1.34E+03
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	6.47E+00	2.32E-07	6.23E+05	1.45E-01
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.23E-01	8.00E-09	7.91E+05	6.33E-03
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	2.21E+00	7.94E-08	7.67E+05	6.09E-02
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.33E-01	4.76E-09	8.16E+05	3.88E-03
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	8.28E-01	2.97E-08	7.32E+05	2.18E-02
	1.54E+04			4.31E+02				2.60E+05

Isotope	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	3.01E+02	1.08E-05	0.00E+00	0.00E+00
Kr-85m	0.00E+00	0.00E+00	7.19E+02	2.58E-05	5.83E+07	1.51E+03
Kr-85	0.00E+00	0.00E+00	1.75E+03	6.29E-05	7.19E+07	4.52E+03
Kr-87	0.00E+00	0.00E+00	4.12E+02	1.48E-05	8.85E+07	1.31E+03
Kr-88	0.00E+00	0.00E+00	1.29E+03	4.62E-05	6.80E+07	3.14E+03
Kr-89	0.00E+00	0.00E+00	2.97E+01	1.06E-06	8.73E+07	9.30E+01
Xe-131m	0.00E+00	0.00E+00	1.47E+03	5.27E-05	4.61E+04	2.43E+00
Xe-133m	0.00E+00	0.00E+00	1.76E+03	6.32E-05	6.06E+04	3.83E+00
Xe-133	0.00E+00	0.00E+00	1.04E+05	3.74E-03	2.94E+07	1.10E+05
Xe-135m	0.00E+00	0.00E+00	1.12E+03	4.02E-05	1.55E+04	6.23E-01
Xe-135	0.00E+00	0.00E+00	8.36E+03	3.00E-04	7.48E+07	2.24E+04
Xe-137	0.00E+00	0.00E+00	7.63E+01	2.74E-06	9.07E+07	2.49E+02
Xe-138	0.00E+00	0.00E+00	2.67E+02	9.57E-06	7.74E+07	7.41E+02
I-131	2.44E+07	7.17E+02	3.57E+00	1.28E-07	6.23E+05	7.99E-02
I-132	2.90E+05	2.93E-01	1.23E-01	4.42E-09	7.91E+05	3.50E-03
I-133	5.77E+06	5.80E+01	1.22E+00	4.39E-08	7.67E+05	3.37E-02
I-134	7.60E+04	4.58E-02	7.33E-02	2.63E-09	8.16E+05	2.15E-03
I-135	1.19E+06	4.47E+00	4.57E-01	1.64E-08	7.32E+05	1.20E-02
		7.79E+02		4.37E-03		1.44E+05

Monitor conversion factor CF11 (uCi/cc-cpm) = 2.45E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
6.38E-01	1.00E+02	2.60E+07	1.76E+00	5.00E+02	7.20E+07
3.19E-01	5.00E+01	1.30E+07	8.81E-01	2.50E+02	3.60E+07
6.38E+00	1.00E+03	2.60E+08	1.76E+01	5.00E+03	7.20E+08

2HVS*RQI-109C Mid Range SLCRS:

Monitor efficiencies from ERS-SFL-86-026
2HVS*RQI-109C

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.31E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 5.75E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.64E+02	9.50E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E+01	4.17E-07	0.00E+00	0.00E+00
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	6.49E+02	2.33E-05	4.88E+04	1.14E+00	0.00E+00	0.00E+00	2.85E+01	1.02E-06	4.88E+04	4.99E-02
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.73E+03	1.34E-04	1.51E+04	2.02E+00	0.00E+00	0.00E+00	1.64E+02	5.88E-06	1.51E+04	8.88E-02
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.48E+02	8.91E-06	1.09E+05	9.71E-01	0.00E+00	0.00E+00	1.09E+01	3.91E-07	1.09E+05	4.27E-02
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	1.05E+03	3.77E-05	4.28E+04	1.61E+00	0.00E+00	0.00E+00	4.62E+01	1.66E-06	4.28E+04	7.10E-02
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	2.20E-01	7.90E-09	1.18E+05	9.33E-04	0.00E+00	0.00E+00	9.67E-03	3.47E-10	1.18E+05	4.10E-05
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	2.13E+03	7.65E-05	5.74E+03	4.39E-01	0.00E+00	0.00E+00	9.36E+01	3.36E-06	5.74E+03	1.93E-02
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.86E+03	6.67E-05	1.41E+04	9.41E-01	0.00E+00	0.00E+00	8.16E+01	2.93E-06	1.41E+04	4.13E-02
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	1.09E+05	3.92E-03	1.38E+04	5.41E+01	0.00E+00	0.00E+00	4.80E+03	1.72E-04	1.38E+04	2.38E+00
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.64E+03	1.31E-04	1.87E+04	2.44E+00	0.00E+00	0.00E+00	1.60E+02	5.74E-06	1.87E+04	1.07E-01
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.95E+03	2.86E-04	4.47E+04	1.28E+01	0.00E+00	0.00E+00	3.49E+02	1.25E-05	4.47E+04	5.61E-01
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	7.48E-01	2.69E-08	1.19E+05	3.20E-03	0.00E+00	0.00E+00	3.29E-02	1.18E-09	1.19E+05	1.41E-04
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.29E+01	8.22E-07	8.00E+04	8.58E-02	0.00E+00	0.00E+00	1.01E+00	3.61E-08	8.00E+04	2.89E-03
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	8.01E+01	2.88E-06	2.16E+02	6.21E-04	2.44E+07	1.49E+04	3.52E+00	1.26E-07	2.16E+02	2.73E-05
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.87E+01	1.39E-06	7.47E+02	1.04E-03	2.90E+05	8.58E+01	1.70E+00	6.11E-08	7.47E+02	4.57E-05
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	3.11E+01	1.12E-06	5.39E+02	6.02E-04	5.77E+06	1.37E+03	1.37E+00	4.91E-08	5.39E+02	2.65E-05
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.91E+00	6.86E-08	9.41E+02	6.46E-05	7.60E+04	1.11E+00	8.39E-02	3.01E-09	9.41E+02	2.84E-06
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	9.92E+00	3.56E-07	4.78E+02	1.70E-04	1.19E+06	9.02E+01	4.36E-01	1.57E-08	4.78E+02	7.48E-06
	4.46E+04			7.24E+02				7.65E+01		1.65E+04		2.07E-04		3.36E+00

Monitor conversion factor CF11 (uCi/cc-cpm) = 4.32E-05

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
3.31E-01	1.00E+02	7.65E+03	7.26E-02	5.00E+02	1.68E+03
1.65E-01	5.00E+01	3.83E+03	3.63E-02	2.50E+02	8.40E+02
3.31E+00	1.00E+03	7.65E+04	7.26E-01	5.00E+03	1.68E+04

Monitor efficiencies from ERS-SFL-86-026
2HVS*RQI-109C

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.51E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 8.58E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	3.10E+02	1.11E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E+01	6.32E-07	0.00E+00	0.00E+00
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	7.60E+02	2.73E-05	4.88E+04	1.33E+00	0.00E+00	0.00E+00	4.31E+01	1.55E-06	4.88E+04	7.55E-02
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	2.19E+03	7.86E-05	1.51E+04	1.19E+00	0.00E+00	0.00E+00	1.24E+02	4.46E-06	1.51E+04	6.73E-02
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.91E+02	1.05E-05	1.09E+05	1.14E+00	0.00E+00	0.00E+00	1.65E+01	5.93E-07	1.09E+05	6.46E-02
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.23E+03	4.43E-05	4.28E+04	1.90E+00	0.00E+00	0.00E+00	7.00E+01	2.51E-06	4.28E+04	1.08E-01
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.58E-01	9.28E-09	1.18E+05	1.10E-03	0.00E+00	0.00E+00	1.47E-02	5.26E-10	1.18E+05	6.21E-05
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.50E+03	8.97E-05	5.74E+03	5.15E-01	0.00E+00	0.00E+00	1.42E+02	5.09E-06	5.74E+03	2.92E-02
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	2.19E+03	7.86E-05	1.41E+04	1.11E+00	0.00E+00	0.00E+00	1.24E+02	4.46E-06	1.41E+04	6.28E-02
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.28E+05	4.60E-03	1.38E+04	6.34E+01	0.00E+00	0.00E+00	7.26E+03	2.61E-04	1.38E+04	3.60E+00
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	4.27E+03	1.53E-04	1.87E+04	2.87E+00	0.00E+00	0.00E+00	2.42E+02	8.70E-06	1.87E+04	1.63E-01
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	9.34E+03	3.35E-04	4.47E+04	1.50E+01	0.00E+00	0.00E+00	5.30E+02	1.90E-05	4.47E+04	8.50E-01
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	8.77E-01	3.15E-08	1.19E+05	3.75E-03	0.00E+00	0.00E+00	4.97E-02	1.79E-09	1.19E+05	2.13E-04
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.69E+01	9.65E-07	8.00E+04	7.72E-02	0.00E+00	0.00E+00	1.52E+00	5.47E-08	8.00E+04	4.38E-03
I-131	3.41E+02	3.88E-04	4.68E+05	1.81E+02	5.88E+01	2.11E-06	2.16E+02	4.56E-04	2.44E+07	9.48E+03	3.33E+00	1.20E-07	2.16E+02	2.58E-05
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.55E+01	1.63E-06	7.47E+02	1.22E-03	2.90E+05	8.72E+01	2.58E+00	9.26E-08	7.47E+02	6.92E-05
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.65E+01	1.31E-06	5.39E+02	7.07E-04	5.77E+06	1.39E+03	2.07E+00	7.44E-08	5.39E+02	4.01E-05
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.24E+00	8.04E-08	9.41E+02	7.57E-05	7.60E+04	1.13E+00	1.27E-01	4.56E-09	9.41E+02	4.29E-06
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.16E+01	4.18E-07	4.78E+02	2.00E-04	1.19E+08	9.15E+01	6.60E-01	2.37E-08	4.78E+02	1.13E-05
	8.78E+05			6.27E+02				8.86E+01		1.10E+04		3.08E-04		5.02E+00

Monitor conversion factor CF11 (uCi/cc-cpm) = 4.32E-05

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
3.83E-01	1.00E+02	8.86E+03	1.08E-01	5.00E+02	2.51E+03
1.91E-01	5.00E+01	4.43E+03	5.42E-02	2.50E+02	1.26E+03
3.83E+00	1.00E+03	8.86E+04	1.08E+00	5.00E+03	2.51E+04

2HVS*RQI-109C Mid Range SLCRS (continued):

X/Q = 9.24E-05 s/m³
Monitor efficiencies from ERS-SFL-88-026 Upstream filtration (Iodines reduced 0.01) Release (uCi/s) CF for TEDE = 7.15E+05 (Expression 5)
2HVS*RQI-109C Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s Release (uCi/s) CF for Child Thyroid = 3.95E+04 (Expression 5)

Isotope	U2 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.63E+01	5.84E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.98E-01	3.22E-08	0.00E+00	0.00E+00
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.71E+01	2.41E-06	4.88E+04	1.18E-01	0.00E+00	0.00E+00	3.71E+00	1.33E-07	4.88E+04	6.49E-03
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.97E+05	1.42E-02	1.51E+04	2.15E+02	0.00E+00	0.00E+00	2.19E+04	7.87E-04	1.51E+04	1.19E+01
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	8.54E+00	3.07E-07	1.09E+05	3.34E-02	0.00E+00	0.00E+00	4.72E-01	1.69E-08	1.09E+05	1.85E-03
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	7.30E+01	2.62E-06	4.28E+04	1.12E-01	0.00E+00	0.00E+00	4.03E+00	1.45E-07	4.28E+04	6.20E-03
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.54E-04	1.27E-11	1.18E+05	1.50E-06	0.00E+00	0.00E+00	1.96E-05	7.03E-13	1.18E+05	8.29E-08
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.43E+04	5.14E-04	5.74E+03	2.95E+00	0.00E+00	0.00E+00	7.91E+02	2.84E-05	5.74E+03	1.63E-01
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	2.20E+03	7.88E-05	1.41E+04	1.11E+00	0.00E+00	0.00E+00	1.21E+02	4.36E-06	1.41E+04	6.14E-02
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	3.01E+05	1.08E-02	1.38E+04	1.49E+02	0.00E+00	0.00E+00	1.66E+04	5.97E-04	1.38E+04	8.24E+00
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.47E+02	5.27E-06	1.87E+04	9.86E-02	0.00E+00	0.00E+00	8.11E+00	2.91E-07	1.87E+04	5.45E-03
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.26E+02	8.10E-06	4.47E+04	3.62E-01	0.00E+00	0.00E+00	1.25E+01	4.48E-07	4.47E+04	2.00E-02
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.44E-03	5.18E-11	1.19E+05	6.17E-08	0.00E+00	0.00E+00	7.97E-05	2.86E-12	1.19E+05	3.41E-07
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.60E-01	5.75E-09	8.00E+04	4.60E-04	0.00E+00	0.00E+00	8.85E-03	3.18E-10	8.00E+04	2.54E-05
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	6.56E+01	2.36E-06	2.16E+02	5.09E-04	2.44E+07	2.24E+03	3.63E+00	1.30E-07	2.16E+02	2.81E-05
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	4.39E+01	1.58E-06	7.47E+02	1.18E-03	2.90E+05	1.78E+01	2.43E+00	8.71E-08	7.47E+02	6.51E-05
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.67E+01	6.01E-07	5.39E+02	3.24E-04	5.77E+06	1.35E+02	9.25E-01	3.32E-08	5.39E+02	1.79E-05
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	4.38E-01	1.57E-08	9.41E+02	1.48E-05	7.60E+04	4.66E-02	2.42E-02	8.69E-10	9.41E+02	8.17E-07
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.56E+00	1.64E-07	4.78E+02	7.83E-05	1.19E+06	7.59E+00	2.52E-01	9.05E-09	4.78E+02	4.33E-06
	5.89E+01			1.33E+02				3.69E+02		2.40E+03		1.42E-03		2.04E+01

Monitor conversion factor CF11 (uCi/cc-cpm) = 4.32E-05

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
1.59E+00	1.00E+02	3.69E+04	4.40E-01	5.00E+02	1.02E+04
7.97E-01	5.00E+01	1.84E+04	2.20E-01	2.50E+02	5.10E+03
1.59E+01	1.00E+03	3.69E+05	4.40E+00	5.00E+03	1.02E+05

X/Q = 9.24E-05 s/m³
Monitor efficiencies from ERS-SFL-86-026 Upstream filtration (Iodines reduced 0.01) Release (uCi/s) CF for TEDE = 2.26E+04 (Expression 5)
2HVS*RQI-109C Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s Release (uCi/s) CF for Child Thyroid = 4.50E+03 (Expression 5)

Isotope	U1 & U2 LOCA TID (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.96E+02	1.06E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.88E+01	2.11E-06	0.00E+00	0.00E+00
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	6.10E+02	2.19E-05	4.88E+04	1.07E+00	0.00E+00	0.00E+00	1.21E+02	4.35E-06	4.88E+04	2.13E-01
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.59E+01	9.28E-07	1.51E+04	1.40E-02	0.00E+00	0.00E+00	5.14E+00	1.85E-07	1.51E+04	2.79E-03
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.22E+03	4.39E-05	1.09E+05	4.78E+00	0.00E+00	0.00E+00	2.43E+02	8.73E-06	1.09E+05	9.52E-01
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.70E+03	6.10E-05	4.28E+04	2.61E+00	0.00E+00	0.00E+00	3.38E+02	1.21E-05	4.28E+04	5.19E-01
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	2.11E+03	7.58E-05	1.18E+05	8.94E+00	0.00E+00	0.00E+00	4.20E+02	1.51E-05	1.18E+05	1.78E+00
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.38E+01	1.21E-06	5.74E+03	6.96E-03	0.00E+00	0.00E+00	6.72E+00	2.41E-07	5.74E+03	1.38E-03
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.58E+02	5.67E-06	1.41E+04	7.99E-02	0.00E+00	0.00E+00	3.14E+01	1.13E-06	1.41E+04	1.59E-02
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	5.00E+03	1.80E-04	1.38E+04	2.48E+00	0.00E+00	0.00E+00	9.95E+02	3.57E-05	1.38E+04	4.93E-01
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	1.05E+03	3.77E-05	1.87E+04	7.05E-01	0.00E+00	0.00E+00	2.09E+02	7.50E-06	1.87E+04	1.40E-01
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.51E+03	5.43E-05	4.47E+04	2.43E+00	0.00E+00	0.00E+00	3.01E+02	1.08E-05	4.47E+04	4.83E-01
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.56E+03	1.64E-04	1.19E+05	1.95E+01	0.00E+00	0.00E+00	9.08E+02	3.26E-05	1.19E+05	3.88E+00
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	4.25E+03	1.53E-04	8.00E+04	1.22E+01	0.00E+00	0.00E+00	8.46E+02	3.04E-05	8.00E+04	2.43E+00
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.22E+01	4.37E-07	2.16E+02	9.43E-05	2.44E+07	1.31E+04	2.42E+00	8.69E-08	2.16E+02	1.88E-05
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.78E+01	6.40E-07	7.47E+02	4.78E-04	2.90E+05	2.28E+02	3.54E+00	1.27E-07	7.47E+02	9.51E-05
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.50E+01	8.98E-07	5.39E+02	4.84E-04	5.77E+06	6.37E+03	4.98E+00	1.79E-07	5.39E+02	9.63E-05
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.77E+01	9.93E-07	9.41E+02	9.35E-04	7.60E+04	9.29E+01	5.50E+00	1.98E-07	9.41E+02	1.86E-04
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.38E+01	8.53E-07	4.78E+02	4.08E-04	1.19E+06	1.25E+03	4.73E+00	1.70E-07	4.78E+02	8.11E-05
	7.24E+08			4.19E+03				5.48E+01		2.10E+04		1.62E-04		1.09E+01

Monitor conversion factor CF11 (uCi/cc-cpm) = 4.32E-05

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
2.37E-01	1.00E+02	5.48E+03	2.36E-01	5.00E+02	5.45E+03
1.18E-01	5.00E+01	2.74E+03	1.18E-01	2.50E+02	2.73E+03
2.37E+00	1.00E+03	5.48E+04	2.36E+00	5.00E+03	5.45E+04

2HVS*RQI-109C Mid Range SLCRS (continued):

Monitor efficiencies from ERS-SFL-88-026
2HVS*RQI-109C

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.05E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.05E+04 (Expression 5)

Isotope	U2 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	6.51E+01	2.34E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.54E+00	2.35E-07	0.00E+00	0.00E+00
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.33E+02	8.36E-06	4.88E+04	4.08E-01	0.00E+00	0.00E+00	2.34E+01	8.40E-07	4.88E+04	4.10E-02
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	2.07E+04	7.42E-04	1.51E+04	1.12E+01	0.00E+00	0.00E+00	2.08E+03	7.46E-05	1.51E+04	1.13E+00
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.47E+02	5.30E-06	1.09E+05	5.77E-01	0.00E+00	0.00E+00	1.48E+01	5.32E-07	1.09E+05	5.80E-02
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	4.29E+02	1.54E-05	4.28E+04	6.59E-01	0.00E+00	0.00E+00	4.31E+01	1.55E-06	4.28E+04	6.62E-02
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.77E+00	1.35E-07	1.18E+05	1.60E-02	0.00E+00	0.00E+00	3.76E-01	1.36E-08	1.18E+05	1.60E-03
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	8.79E+02	3.15E-05	5.74E+03	1.81E-01	0.00E+00	0.00E+00	8.83E+01	3.17E-06	5.74E+03	1.82E-02
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.87E+02	2.83E-05	1.41E+04	3.98E-01	0.00E+00	0.00E+00	7.91E+01	2.84E-06	1.41E+04	4.01E-02
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	5.28E+04	1.90E-03	1.38E+04	2.62E+01	0.00E+00	0.00E+00	5.31E+03	1.91E-04	1.38E+04	2.63E+00
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.33E+04	8.37E-04	1.87E+04	1.56E+01	0.00E+00	0.00E+00	2.34E+03	8.41E-05	1.87E+04	1.57E+00
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	5.23E+03	1.88E-04	4.47E+04	8.39E+00	0.00E+00	0.00E+00	5.26E+02	1.89E-05	4.47E+04	8.44E-01
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.14E+01	4.09E-07	1.19E+05	4.87E-02	0.00E+00	0.00E+00	1.15E+00	4.11E-08	1.19E+05	4.90E-03
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.92E+01	2.84E-06	8.00E+04	2.28E-01	0.00E+00	0.00E+00	7.96E+00	2.86E-07	8.00E+04	2.29E-02
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.59E+01	9.31E-07	2.16E+02	2.01E-04	2.44E+07	6.04E+03	2.61E+00	9.36E-08	2.16E+02	2.02E-05
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.67E+01	9.58E-07	7.47E+02	7.15E-04	2.90E+05	7.38E+01	2.68E+00	9.63E-08	7.47E+02	7.19E-05
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.50E+01	1.61E-06	5.39E+02	8.70E-04	5.77E+06	2.48E+03	4.52E+00	1.62E-07	5.39E+02	8.75E-05
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	3.09E+01	1.11E-06	9.41E+02	1.04E-03	7.60E+04	2.24E+01	3.10E+00	1.11E-07	9.41E+02	1.05E-04
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.43E+01	1.23E-06	4.78E+02	5.88E-04	1.19E+06	3.89E+02	3.44E+00	1.24E-07	4.78E+02	5.91E-05
	4.01E+02			9.05E+02				6.39E+01		9.00E+03		3.78E-04		6.43E+00

Monitor conversion factor CF11 (uCi/cc-cpm) = 4.32E-05

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
2.76E-01	1.00E+02	6.39E+03	1.39E-01	5.00E+02	3.21E+03
1.38E-01	5.00E+01	3.20E+03	6.94E-02	2.50E+02	1.61E+03
2.76E+00	1.00E+03	6.39E+04	1.39E+00	5.00E+03	3.21E+04

Monitor efficiencies from ERS-SFL-88-026
2HVS*RQI-109C

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 5.24E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.48E+05 (Expression 5)

Isotope	U1 & U2 FHA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	4.69E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85m	1.04E-03	3.07E-08	8.17E+02	2.50E-05	1.61E-02	5.77E-10	4.88E+04	2.81E-05	0.00E+00	0.00E+00	7.61E-03	2.73E-10	4.88E+04	1.33E-05
Kr-85	4.78E+02	1.41E-02	1.12E+01	1.58E-01	7.38E+03	2.65E-04	1.51E+04	4.00E+00	0.00E+00	0.00E+00	3.50E+03	1.26E-04	1.51E+04	1.90E+00
Kr-87	0.00E+00	0.00E+00	4.47E+03	0.00E+00	0.00E+00	0.00E+00	1.09E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E+05	0.00E+00
Kr-88	0.00E+00	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	4.28E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.28E+04	0.00E+00
Kr-89	0.00E+00	0.00E+00	1.02E+04	0.00E+00	0.00E+00	0.00E+00	1.18E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E+05	0.00E+00
Xe-131m	4.66E+02	1.37E-02	4.29E+01	5.89E-01	7.19E+03	2.58E-04	5.74E+03	1.48E+00	0.00E+00	0.00E+00	3.41E+03	1.22E-04	5.74E+03	7.03E-01
Xe-133m	6.16E+02	1.82E-02	1.49E+02	2.71E+00	9.51E+03	3.41E-04	1.41E+04	4.81E+00	0.00E+00	0.00E+00	4.51E+03	1.62E-04	1.41E+04	2.28E+00
Xe-133	3.23E+04	9.52E-01	1.76E+02	1.68E+02	4.99E+05	1.79E-02	1.38E+04	2.47E+02	0.00E+00	0.00E+00	2.36E+05	8.49E-03	1.38E+04	1.17E+02
Xe-135m	2.65E+00	7.81E-05	2.15E+03	1.68E-01	4.09E+01	1.47E-06	1.87E+04	2.75E-02	0.00E+00	0.00E+00	1.94E+01	6.96E-07	1.87E+04	1.30E-02
Xe-135	6.10E+01	1.80E-03	1.25E+03	2.25E+00	9.42E+02	3.38E-05	4.47E+04	1.51E+00	0.00E+00	0.00E+00	4.46E+02	1.60E-05	4.47E+04	7.17E-01
Xe-137	0.00E+00	0.00E+00	9.55E+02	0.00E+00	0.00E+00	0.00E+00	1.19E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E+05	0.00E+00
Xe-138	0.00E+00	0.00E+00	6.27E+03	0.00E+00	0.00E+00	0.00E+00	8.00E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.00E+04	0.00E+00
I-131	5.20E-01	1.53E-05	4.66E+05	7.14E+00	8.03E+00	2.88E-07	2.16E+02	6.23E-05	2.44E+07	3.74E+02	3.81E+00	1.37E-07	2.16E+02	2.95E-05
I-132	2.52E-01	7.43E-06	4.33E+04	3.22E-01	3.89E+00	1.40E-07	7.47E+02	1.04E-04	2.90E+05	2.15E+00	1.84E+00	6.62E-08	7.47E+02	4.95E-05
I-133	3.35E-02	9.87E-07	1.28E+05	1.26E-01	5.17E-01	1.86E-08	5.39E+02	1.00E-05	5.77E+06	5.70E+00	2.45E-01	8.80E-09	5.39E+02	4.75E-06
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	9.41E+02	0.00E+00	7.60E+04	0.00E+00	0.00E+00	0.00E+00	9.41E+02	0.00E+00
I-135	2.23E-05	6.57E-10	7.10E+04	4.67E-05	3.44E-04	1.24E-11	4.78E+02	5.91E-09	1.19E+06	7.82E-04	1.63E-04	5.86E-12	4.78E+02	2.80E-09
	3.39E+04			1.81E+02				2.59E+02		3.82E+02		8.92E-03		1.23E+02

Monitor conversion factor CF11 (uCi/cc-cpm) = 4.32E-05

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
1.12E+00	1.00E+02	2.59E+04	2.65E+00	5.00E+02	6.14E+04
5.59E-01	5.00E+01	1.29E+04	1.33E+00	2.50E+02	3.07E+04
1.12E+01	1.00E+03	2.59E+05	2.65E+01	5.00E+03	6.14E+05

2HVS*RQI-109C Mid Range SLCRS (continued):

Monitor efficiencies from ERS-SFL-86-026
2HVS*RQI-109C

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m^3
Release (uCi/s) CF for TEDE = 2.20E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.22E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m^3/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	5.45E+02	1.96E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.01E+02	1.08E-05	0.00E+00	0.00E+00
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.30E+03	4.67E-05	4.88E+04	2.28E+00	0.00E+00	0.00E+00	7.19E+02	2.58E-05	4.88E+04	1.26E+00
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	3.17E+03	1.14E-04	1.51E+04	1.72E+00	0.00E+00	0.00E+00	1.75E+03	6.29E-05	1.51E+04	9.49E-01
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	7.45E+02	2.68E-05	1.09E+05	2.92E+00	0.00E+00	0.00E+00	4.12E+02	1.48E-05	1.09E+05	1.61E+00
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.33E+03	8.35E-05	4.28E+04	3.58E+00	0.00E+00	0.00E+00	1.29E+03	4.62E-05	4.28E+04	1.98E+00
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	5.37E+01	1.93E-06	1.18E+05	2.27E-01	0.00E+00	0.00E+00	2.97E+01	1.06E-06	1.18E+05	1.26E-01
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.65E+03	9.53E-05	5.74E+03	5.47E-01	0.00E+00	0.00E+00	1.47E+03	5.27E-05	5.74E+03	3.02E-01
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	3.18E+03	1.14E-04	1.41E+04	1.61E+00	0.00E+00	0.00E+00	1.76E+03	6.32E-05	1.41E+04	8.90E-01
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.88E+05	6.77E-03	1.38E+04	9.34E+01	0.00E+00	0.00E+00	1.04E+05	3.74E-03	1.38E+04	5.16E+01
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	2.03E+03	7.28E-05	1.87E+04	1.36E+00	0.00E+00	0.00E+00	1.12E+03	4.02E-05	1.87E+04	7.52E-01
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.51E+04	5.43E-04	4.47E+04	2.43E+01	0.00E+00	0.00E+00	8.36E+03	3.00E-04	4.47E+04	1.34E+01
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.38E+02	4.96E-06	1.19E+05	5.90E-01	0.00E+00	0.00E+00	7.63E+01	2.74E-06	1.19E+05	3.26E-01
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.82E+02	1.73E-05	8.00E+04	1.39E+00	0.00E+00	0.00E+00	2.67E+02	9.57E-06	8.00E+04	7.66E-01
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	6.47E+00	2.32E-07	2.16E+02	5.01E-05	2.44E+07	7.17E+02	3.57E+00	1.28E-07	2.16E+02	2.77E-05
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.23E-01	8.00E-09	7.47E+02	5.97E-06	2.90E+05	2.93E-01	1.23E-01	4.42E-09	7.47E+02	3.30E-06
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	2.21E+00	7.94E-08	5.39E+02	4.28E-05	5.77E+06	5.80E+01	1.22E+00	4.39E-08	5.39E+02	2.37E-05
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.33E-01	4.76E-09	9.41E+02	4.48E-06	7.60E+04	4.58E-02	7.33E-02	2.63E-09	9.41E+02	2.48E-06
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	8.28E-01	2.97E-08	4.78E+02	1.42E-05	1.19E+06	4.47E+00	4.57E-01	1.64E-08	4.78E+02	7.85E-06
	1.54E+04			4.31E+02				1.34E+02		7.79E+02		4.37E-03		7.40E+01

Monitor conversion factor CF11 (uCi/cc-cpm) = 4.32E-05

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
5.78E-01	1.00E+02	1.34E+04	1.60E+00	5.00E+02	3.70E+04
2.89E-01	5.00E+01	6.69E+03	7.99E-01	2.50E+02	1.85E+04
5.78E+00	1.00E+03	1.34E+05	1.60E+01	5.00E+03	3.70E+05

2HVS*RQI-109D High Range SLCRS:

Monitor efficiencies from ERS-SFL-86-026
2HVS*RQI-109D
Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s
X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.31E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 5.75E+03 (Expression 5)

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.64E+02	9.50E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E+01	4.17E-07	0.00E+00	0.00E+00
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	6.49E+02	2.33E-05	1.79E+02	4.17E-03	0.00E+00	0.00E+00	2.85E+01	1.02E-06	1.79E+02	1.83E-04
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.73E+03	1.34E-04	5.89E+01	7.88E-03	0.00E+00	0.00E+00	1.64E+02	5.88E-06	5.89E+01	3.46E-04
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.48E+02	8.91E-06	4.31E+02	3.84E-03	0.00E+00	0.00E+00	1.09E+01	3.91E-07	4.31E+02	1.69E-04
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	1.05E+03	3.77E-05	1.63E+02	6.15E-03	0.00E+00	0.00E+00	4.62E+01	1.66E-06	1.63E+02	2.70E-04
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	2.20E-01	7.90E-09	4.63E+02	3.66E-06	0.00E+00	0.00E+00	9.67E-03	3.47E-10	4.63E+02	1.61E-07
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	2.13E+03	7.65E-05	2.25E+01	1.72E-03	0.00E+00	0.00E+00	9.36E+01	3.36E-06	2.25E+01	7.56E-05
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.86E+03	6.67E-05	5.50E+01	3.67E-03	0.00E+00	0.00E+00	8.16E+01	2.93E-06	5.50E+01	1.61E-04
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	1.09E+05	3.92E-03	4.82E+01	1.89E-01	0.00E+00	0.00E+00	4.80E+03	1.72E-04	4.82E+01	8.30E-03
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.64E+03	1.31E-04	7.16E+01	9.36E-03	0.00E+00	0.00E+00	1.60E+02	5.74E-06	7.16E+01	4.11E-04
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.95E+03	2.86E-04	1.69E+02	4.83E-02	0.00E+00	0.00E+00	3.49E+02	1.25E-05	1.69E+02	2.12E-03
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	7.48E-01	2.69E-08	4.72E+02	1.27E-05	0.00E+00	0.00E+00	3.29E-02	1.18E-09	4.72E+02	5.57E-07
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.29E+01	8.22E-07	3.11E+02	2.56E-04	0.00E+00	0.00E+00	1.01E+00	3.61E-08	3.11E+02	1.12E-05
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	8.01E+01	2.88E-06	8.07E-01	2.32E-06	2.44E+07	1.49E+04	3.52E+00	1.26E-07	8.07E-01	1.02E-07
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.87E+01	1.39E-06	2.87E+00	3.99E-06	2.90E+05	8.58E+01	1.70E+00	6.11E-08	2.87E+00	1.75E-07
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	3.11E+01	1.12E-06	2.10E+00	2.35E-06	5.77E+08	1.37E+03	1.37E+00	4.91E-08	2.10E+00	1.03E-07
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.91E+00	6.86E-08	3.64E+00	2.50E-07	7.60E+04	1.11E+00	8.39E-02	3.01E-09	3.64E+00	1.10E-08
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	9.92E+00	3.56E-07	1.86E+00	6.63E-07	1.19E+06	9.02E+01	4.36E-01	1.57E-08	1.86E+00	2.91E-08
	4.46E+04			7.24E+02				2.74E-01		1.65E+04		2.07E-04		1.21E-02

Monitor conversion factor CF11 (uCi/cc-cpm) = 1.07E-02

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
2.94E-01	1.00E+02	2.74E+01	6.45E-02	5.00E+02	6.03E+00
1.47E-01	5.00E+01	1.37E+01	3.22E-02	2.50E+02	3.01E+00
2.94E+00	1.00E+03	2.74E+02	6.45E-01	5.00E+03	6.03E+01

Monitor efficiencies from ERS-SFL-86-026
2HVS*RQI-109D
Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s
X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.51E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 6.58E+03 (Expression 5)

Isotope	U1 & U2 DBA LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	3.10E+02	1.11E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E+01	6.32E-07	0.00E+00	0.00E+00
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	7.60E+02	2.73E-05	1.79E+02	4.88E-03	0.00E+00	0.00E+00	4.31E+01	1.55E-06	1.79E+02	2.77E-04
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	2.19E+03	7.86E-05	5.89E+01	4.63E-03	0.00E+00	0.00E+00	1.24E+02	4.46E-06	5.89E+01	2.62E-04
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.91E+02	1.05E-05	4.31E+02	4.51E-03	0.00E+00	0.00E+00	1.65E+01	5.93E-07	4.31E+02	2.56E-04
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.23E+03	4.43E-05	1.63E+02	7.22E-03	0.00E+00	0.00E+00	7.00E+01	2.51E-06	1.63E+02	4.10E-04
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.58E-01	9.28E-09	4.63E+02	4.30E-06	0.00E+00	0.00E+00	1.47E-02	5.26E-10	4.63E+02	2.44E-07
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.50E+03	8.97E-05	2.25E+01	2.02E-03	0.00E+00	0.00E+00	1.42E+02	5.09E-06	2.25E+01	1.14E-04
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	2.19E+03	7.86E-05	5.50E+01	4.32E-03	0.00E+00	0.00E+00	1.24E+02	4.46E-06	5.50E+01	2.45E-04
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.28E+05	4.60E-03	4.82E+01	2.22E-01	0.00E+00	0.00E+00	7.26E+03	2.61E-04	4.82E+01	1.26E-02
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	4.27E+03	1.53E-04	7.16E+01	1.10E-02	0.00E+00	0.00E+00	2.42E+02	8.70E-06	7.16E+01	6.23E-04
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	9.34E+03	3.35E-04	1.69E+02	5.67E-02	0.00E+00	0.00E+00	5.30E+02	1.90E-05	1.69E+02	3.21E-03
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	8.77E-01	3.15E-08	4.72E+02	1.49E-05	0.00E+00	0.00E+00	4.97E-02	1.79E-09	4.72E+02	8.43E-07
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.69E+01	9.65E-07	3.11E+02	3.00E-04	0.00E+00	0.00E+00	1.52E+00	5.47E-08	3.11E+02	1.70E-05
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.88E+01	2.11E-06	8.07E-01	1.70E-06	2.44E+07	9.48E+03	3.33E+00	1.20E-07	8.07E-01	9.66E-08
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.55E+01	1.63E-06	2.87E+00	4.69E-06	2.90E+05	8.72E+01	2.58E+00	9.26E-08	2.87E+00	2.66E-07
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.65E+01	1.31E-06	2.10E+00	2.75E-06	5.77E+06	1.39E+03	2.07E+00	7.44E-08	2.10E+00	1.56E-07
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.24E+00	8.04E-08	3.64E+00	2.93E-07	7.60E+04	1.13E+00	1.27E-01	4.56E-09	3.64E+00	1.66E-08
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.16E+01	4.18E-07	1.86E+00	7.77E-07	1.19E+06	9.15E+01	6.60E-01	2.37E-08	1.86E+00	4.41E-08
	8.78E+05			6.27E+02				3.17E-01		1.10E+04		3.08E-04		1.80E-02

Monitor conversion factor CF11 (uCi/cc-cpm) = 1.07E-02

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
3.39E-01	1.00E+02	3.17E+01	9.62E-02	5.00E+02	8.99E+00
1.70E-01	5.00E+01	1.59E+01	4.81E-02	2.50E+02	4.50E+00
3.39E+00	1.00E+03	3.17E+02	9.62E-01	5.00E+03	8.99E+01

2HVS*RQI-109D High Range SLCRS (continued):

Monitor efficiencies from ERS-SFL-86-026
2HVS*RQI-109D

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 7.15E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.95E+04 (Expression 5)

Isotope	U2 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.63E+01	5.84E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.98E-01	3.22E-08	0.00E+00	0.00E+00
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.71E+01	2.41E-06	1.79E+02	4.31E-04	0.00E+00	0.00E+00	3.71E+00	1.33E-07	1.79E+02	2.38E-05
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.97E+05	1.42E-02	5.89E+01	8.39E-01	0.00E+00	0.00E+00	2.19E+04	7.87E-04	5.89E+01	4.63E-02
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	8.54E+00	3.07E-07	4.31E+02	1.32E-04	0.00E+00	0.00E+00	4.72E-01	1.69E-08	4.31E+02	7.30E-06
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	7.30E+01	2.62E-06	1.63E+02	4.27E-04	0.00E+00	0.00E+00	4.03E+00	1.45E-07	1.63E+02	2.36E-05
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.54E-04	1.27E-11	4.63E+02	5.89E-09	0.00E+00	0.00E+00	1.96E-05	7.03E-13	4.63E+02	3.25E-10
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.43E+04	5.14E-04	2.25E+01	1.16E-02	0.00E+00	0.00E+00	7.91E+02	2.84E-05	2.25E+01	6.39E-04
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	2.20E+03	7.88E-05	5.50E+01	4.34E-03	0.00E+00	0.00E+00	1.21E+02	4.36E-06	5.50E+01	2.40E-04
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	3.01E+05	1.08E-02	4.82E+01	5.21E-01	0.00E+00	0.00E+00	1.66E+04	5.97E-04	4.82E+01	2.88E-02
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.47E+02	5.27E-06	7.16E+01	3.77E-04	0.00E+00	0.00E+00	8.11E+00	2.91E-07	7.16E+01	2.08E-05
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.26E+02	8.10E-06	1.69E+02	1.37E-03	0.00E+00	0.00E+00	1.25E+01	4.48E-07	1.69E+02	7.56E-05
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.44E-03	5.18E-11	4.72E+02	2.45E-08	0.00E+00	0.00E+00	7.97E-05	2.86E-12	4.72E+02	1.35E-09
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.60E-01	5.75E-09	3.11E+02	1.79E-06	0.00E+00	0.00E+00	8.85E-03	3.18E-10	3.11E+02	9.88E-08
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	6.56E+01	2.36E-06	8.07E-01	1.90E-06	2.44E+07	2.24E+03	3.63E+00	1.30E-07	8.07E-01	1.05E-07
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	4.39E+01	1.58E-06	2.87E+00	4.53E-06	2.90E+05	1.78E+01	2.43E+00	8.71E-08	2.87E+00	2.50E-07
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.67E+01	6.01E-07	2.10E+00	1.26E-06	5.77E+06	1.35E+02	9.25E-01	3.32E-08	2.10E+00	6.97E-08
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	4.38E-01	1.57E-08	3.64E+00	5.72E-08	7.60E+04	4.66E-02	2.42E-02	8.69E-10	3.64E+00	3.16E-09
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.56E+00	1.64E-07	1.86E+00	3.05E-07	1.19E+06	7.59E+00	2.52E-01	9.05E-09	1.86E+00	1.68E-08
	5.89E+01			1.33E+02				1.38E+00		2.40E+03		1.42E-03		7.61E-02

Monitor conversion factor CF11 (uCi/cc-cpm) = 1.07E-02

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
1.47E+00	1.00E+02	1.38E+02	4.07E-01	5.00E+02	3.81E+01
7.37E-01	5.00E+01	6.89E+01	2.04E-01	2.50E+02	1.90E+01
1.47E+01	1.00E+03	1.38E+03	4.07E+00	5.00E+03	3.81E+02

Monitor efficiencies from ERS-SFL-86-026
2HVS*RQI-109D

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 2.26E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 4.50E+03 (Expression 5)

Isotope	U1 & U2 LOCA TID (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.86E+02	1.06E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.88E+01	2.11E-06	0.00E+00	0.00E+00
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	6.10E+02	2.19E-05	1.79E+02	3.92E-03	0.00E+00	0.00E+00	1.21E+02	4.35E-06	1.79E+02	7.79E-04
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.59E+01	9.28E-07	5.89E+01	5.47E-05	0.00E+00	0.00E+00	5.14E+00	1.85E-07	5.89E+01	1.09E-05
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.22E+03	4.39E-05	4.31E+02	1.89E-02	0.00E+00	0.00E+00	2.43E+02	8.73E-06	4.31E+02	3.76E-03
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.70E+03	6.10E-05	1.63E+02	9.94E-03	0.00E+00	0.00E+00	3.38E+02	1.21E-05	1.63E+02	1.98E-03
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	2.11E+03	7.58E-05	4.63E+02	3.51E-02	0.00E+00	0.00E+00	4.20E+02	1.51E-05	4.63E+02	6.98E-03
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.38E+01	1.21E-06	2.25E+01	2.73E-05	0.00E+00	0.00E+00	6.72E+00	2.41E-07	2.25E+01	5.43E-06
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.58E+02	5.67E-06	5.50E+01	3.12E-04	0.00E+00	0.00E+00	3.14E+01	1.13E-06	5.50E+01	6.20E-05
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	5.00E+03	1.80E-04	4.82E+01	8.66E-03	0.00E+00	0.00E+00	9.95E+02	3.57E-05	4.82E+01	1.72E-03
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	1.05E+03	3.77E-05	7.16E+01	2.70E-03	0.00E+00	0.00E+00	2.09E+02	7.50E-06	7.16E+01	5.37E-04
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.51E+03	5.43E-05	1.69E+02	9.18E-03	0.00E+00	0.00E+00	3.01E+02	1.08E-05	1.69E+02	1.83E-03
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.56E+03	1.64E-04	4.72E+02	7.74E-02	0.00E+00	0.00E+00	9.08E+02	3.26E-05	4.72E+02	1.54E-02
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	4.25E+03	1.53E-04	3.11E+02	4.75E-02	0.00E+00	0.00E+00	8.46E+02	3.04E-05	3.11E+02	9.45E-03
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.22E+01	4.37E-07	8.07E-01	3.52E-07	2.44E+07	1.31E+04	2.42E+00	8.69E-08	8.07E-01	7.01E-08
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.78E+01	6.40E-07	2.87E+00	1.84E-06	2.90E+05	2.28E+02	3.54E+00	1.27E-07	2.87E+00	3.65E-07
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.50E+01	8.98E-07	2.10E+00	1.89E-06	5.77E+06	6.37E+03	4.98E+00	1.79E-07	2.10E+00	3.75E-07
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.77E+01	9.93E-07	3.64E+00	3.62E-06	7.60E+04	9.29E+01	5.50E+00	1.98E-07	3.64E+00	7.19E-07
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.38E+01	8.53E-07	1.86E+00	1.59E-06	1.19E+06	1.25E+03	4.73E+00	1.70E-07	1.86E+00	3.16E-07
	7.24E+08			4.19E+03				2.14E-01		2.10E+04		1.62E-04		4.25E-02

Monitor conversion factor CF11 (uCi/cc-cpm) = 1.07E-02

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
2.29E-01	1.00E+02	2.14E+01	2.27E-01	5.00E+02	2.12E+01
1.14E-01	5.00E+01	1.07E+01	1.14E-01	2.50E+02	1.06E+01
2.29E+00	1.00E+03	2.14E+02	2.27E+00	5.00E+03	2.12E+02

2HVS*RQI-109D High Range SLCRS (continued):

Monitor efficiencies from ERS-SFL-88-026
2HVS*RQI-109D

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.05E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.05E+04 (Expression 5)

Isotope	U2 only SB LOCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	6.51E+01	2.34E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.54E+00	2.35E-07	0.00E+00	0.00E+00
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.33E+02	8.36E-06	1.79E+02	1.50E-03	0.00E+00	0.00E+00	2.34E+01	8.40E-07	1.79E+02	1.50E-04
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	2.07E+04	7.42E-04	5.89E+01	4.37E-02	0.00E+00	0.00E+00	2.08E+03	7.46E-05	5.89E+01	4.39E-03
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.47E+02	5.30E-06	4.31E+02	2.28E-03	0.00E+00	0.00E+00	1.48E+01	5.32E-07	4.31E+02	2.29E-04
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	4.29E+02	1.54E-05	1.63E+02	2.51E-03	0.00E+00	0.00E+00	4.31E+01	1.55E-06	1.63E+02	2.52E-04
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.77E+00	1.35E-07	4.63E+02	6.26E-05	0.00E+00	0.00E+00	3.78E-01	1.36E-08	4.63E+02	6.29E-06
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	8.79E+02	3.15E-05	2.25E+01	7.10E-04	0.00E+00	0.00E+00	8.83E+01	3.17E-06	2.25E+01	7.13E-05
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.87E+02	2.83E-05	5.50E+01	1.55E-03	0.00E+00	0.00E+00	7.91E+01	2.84E-06	5.50E+01	1.56E-04
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	5.28E+04	1.90E-03	4.82E+01	9.14E-02	0.00E+00	0.00E+00	5.31E+03	1.91E-04	4.82E+01	9.19E-03
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.33E+04	8.37E-04	7.16E+01	5.99E-02	0.00E+00	0.00E+00	2.34E+03	8.41E-05	7.16E+01	6.02E-03
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	5.23E+03	1.88E-04	1.69E+02	3.17E-02	0.00E+00	0.00E+00	5.26E+02	1.89E-05	1.69E+02	3.19E-03
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.14E+01	4.09E-07	4.72E+02	1.93E-04	0.00E+00	0.00E+00	1.15E+00	4.11E-08	4.72E+02	1.94E-05
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.92E+01	2.84E-06	3.11E+02	8.85E-04	0.00E+00	0.00E+00	7.96E+00	2.86E-07	3.11E+02	8.89E-05
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.59E+01	9.31E-07	8.07E-01	7.52E-07	2.44E+07	6.04E+03	2.61E+00	9.36E-08	8.07E-01	7.55E-08
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.67E+01	9.58E-07	2.87E+00	2.75E-06	2.90E+05	7.38E+01	2.68E+00	9.63E-08	2.87E+00	2.76E-07
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.50E+01	1.61E-06	2.10E+00	3.39E-06	5.77E+06	2.48E+03	4.52E+00	1.62E-07	2.10E+00	3.41E-07
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	3.09E+01	1.11E-06	3.64E+00	4.03E-06	7.60E+04	2.24E+01	3.10E+00	1.11E-07	3.64E+00	4.05E-07
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.43E+01	1.23E-06	1.86E+00	2.29E-06	1.19E+06	3.89E+02	3.44E+00	1.24E-07	1.86E+00	2.30E-07
	4.01E+02			9.05E+02				2.36E-01		9.00E+03		3.78E-04		2.38E-02

Monitor conversion factor CF11 (uCi/cc-cpm) = 1.07E-02

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
2.53E-01	1.00E+02	2.36E+01	1.27E-01	5.00E+02	1.19E+01
1.26E-01	5.00E+01	1.18E+01	6.36E-02	2.50E+02	5.94E+00
2.53E+00	1.00E+03	2.36E+02	1.27E+00	5.00E+03	1.19E+02

Monitor efficiencies from ERS-SFL-88-026
2HVS*RQI-109D

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 5.90E+04 cfm : 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 5.24E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.48E+05 (Expression 5)

Isotope	U1 & U2 FHA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	4.69E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85m	1.04E-03	3.07E-08	8.17E+02	2.50E-05	1.61E-02	5.77E-10	1.79E+02	1.03E-07	0.00E+00	0.00E+00	7.61E-03	2.73E-10	1.79E+02	4.89E-08
Kr-85	4.78E+02	1.41E-02	1.12E+01	1.58E-01	7.38E+03	2.65E-04	5.89E+01	1.56E-02	0.00E+00	0.00E+00	3.50E+03	1.26E-04	5.89E+01	7.40E-03
Kr-87	0.00E+00	0.00E+00	4.47E+03	0.00E+00	0.00E+00	0.00E+00	4.31E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.31E+02	0.00E+00
Kr-88	0.00E+00	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	1.63E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.63E+02	0.00E+00
Kr-89	0.00E+00	0.00E+00	1.02E+04	0.00E+00	0.00E+00	0.00E+00	4.63E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.63E+02	0.00E+00
Xe-131m	4.66E+02	1.37E-02	4.29E+01	5.89E-01	7.19E+03	2.58E-04	2.25E+01	5.81E-03	0.00E+00	0.00E+00	3.41E+03	1.22E-04	2.25E+01	2.76E-03
Xe-133m	6.16E+02	1.82E-02	1.49E+02	2.71E+00	9.51E+03	3.41E-04	5.50E+01	1.88E-02	0.00E+00	0.00E+00	4.51E+03	1.62E-04	5.50E+01	8.90E-03
Xe-133	3.23E+04	9.52E-01	1.76E+02	1.68E+02	4.99E+05	1.79E-02	4.82E+01	8.63E-01	0.00E+00	0.00E+00	2.36E+05	8.49E-03	4.82E+01	4.09E-01
Xe-135m	2.65E+00	7.81E-05	2.15E+03	1.68E-01	4.09E+01	1.47E-06	7.16E+01	1.05E-04	0.00E+00	0.00E+00	1.94E+01	6.96E-07	7.16E+01	4.99E-05
Xe-135	6.10E+01	1.80E-03	1.25E+03	2.25E+00	9.42E+02	3.38E-05	1.69E+02	5.71E-03	0.00E+00	0.00E+00	4.46E+02	1.60E-05	1.69E+02	2.71E-03
Xe-137	0.00E+00	0.00E+00	9.55E+02	0.00E+00	0.00E+00	0.00E+00	4.72E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.72E+02	0.00E+00
Xe-138	0.00E+00	0.00E+00	6.27E+03	0.00E+00	0.00E+00	0.00E+00	3.11E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.11E+02	0.00E+00
I-131	5.20E-01	1.53E-05	4.66E+05	7.14E+00	8.03E+00	2.88E-07	8.07E-01	2.33E-07	2.44E+07	3.74E+02	3.81E+00	1.37E-07	8.07E-01	1.10E-07
I-132	2.52E-01	7.43E-06	4.33E+04	3.22E-01	3.89E+00	1.40E-07	2.87E+00	4.01E-07	2.90E+05	2.15E+00	1.84E+00	6.62E-08	2.87E+00	1.90E-07
I-133	3.35E-02	9.87E-07	1.28E+05	1.26E-01	5.17E-01	1.86E-08	2.10E+00	3.90E-08	5.77E+06	5.70E+00	2.45E-01	8.80E-09	2.10E+00	1.85E-08
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	3.64E+00	0.00E+00	7.60E+04	0.00E+00	0.00E+00	0.00E+00	3.64E+00	0.00E+00
I-135	2.23E-05	6.57E-10	7.10E+04	4.67E-05	3.44E-04	1.24E-11	1.86E+00	2.30E-11	1.19E+06	7.82E-04	1.63E-04	5.86E-12	1.86E+00	1.09E-11
	3.39E+04			1.81E+02				9.09E-01		3.82E+02		8.92E-03		4.31E-01

Monitor conversion factor CF11 (uCi/cc-cpm) = 1.07E-02

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
9.73E-01	1.00E+02	9.09E+01	2.31E+00	5.00E+02	2.15E+02
4.86E-01	5.00E+01	4.55E+01	1.15E+00	2.50E+02	1.08E+02
9.73E+00	1.00E+03	9.09E+02	2.31E+01	5.00E+03	2.15E+03

2HVS*RQI-109D High Range SLCRS (continued):

Monitor efficiencies from ERS-SFL-88-028
2HVS*RQI-109D

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 5.90E+04 cfm 2.78E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 2.20E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 1.22E+05 (Expression 5)

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.62E+01	2.48E-03	4.69E-01	1.16E-03	5.45E+02	1.96E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.01E+02	1.08E-05	0.00E+00	0.00E+00
Kr-85m	9.12E+01	5.91E-03	6.17E+02	4.83E+00	1.30E+03	4.67E-05	1.79E+02	8.37E-03	0.00E+00	0.00E+00	7.19E+02	2.58E-05	1.79E+02	4.62E-03
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	3.17E+03	1.14E-04	5.89E+01	6.70E-03	0.00E+00	0.00E+00	1.75E+03	6.29E-05	5.89E+01	3.70E-03
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	7.45E+02	2.68E-05	4.31E+02	1.15E-02	0.00E+00	0.00E+00	4.12E+02	1.48E-05	4.31E+02	6.37E-03
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.33E+03	8.35E-05	1.63E+02	1.36E-02	0.00E+00	0.00E+00	1.29E+03	4.62E-05	1.63E+02	7.52E-03
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	5.37E+01	1.93E-06	4.63E+02	8.92E-04	0.00E+00	0.00E+00	2.97E+01	1.06E-06	4.63E+02	4.93E-04
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.65E+03	9.53E-05	2.25E+01	2.14E-03	0.00E+00	0.00E+00	1.47E+03	5.27E-05	2.25E+01	1.19E-03
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	3.18E+03	1.14E-04	5.50E+01	6.29E-03	0.00E+00	0.00E+00	1.76E+03	6.32E-05	5.50E+01	3.47E-03
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.88E+05	6.77E-03	4.82E+01	3.26E-01	0.00E+00	0.00E+00	1.04E+05	3.74E-03	4.82E+01	1.80E-01
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	2.03E+03	7.28E-05	7.16E+01	5.21E-03	0.00E+00	0.00E+00	1.12E+03	4.02E-05	7.16E+01	2.88E-03
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.51E+04	5.43E-04	1.69E+02	9.18E-02	0.00E+00	0.00E+00	8.36E+03	3.00E-04	1.69E+02	5.07E-02
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.38E+02	4.96E-06	4.72E+02	2.34E-03	0.00E+00	0.00E+00	7.63E+01	2.74E-06	4.72E+02	1.29E-03
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.82E+02	1.73E-05	3.11E+02	5.39E-03	0.00E+00	0.00E+00	2.67E+02	9.57E-06	3.11E+02	2.98E-03
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	6.47E+00	2.32E-07	8.07E-01	1.87E-07	2.44E+07	7.17E+02	3.57E+00	1.28E-07	8.07E-01	1.04E-07
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.23E-01	8.00E-09	2.87E+00	2.29E-08	2.90E+05	2.93E-01	1.23E-01	4.42E-09	2.87E+00	1.27E-08
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	2.21E+00	7.94E-08	2.10E+00	1.67E-07	5.77E+06	5.80E+01	1.22E+00	4.39E-08	2.10E+00	9.22E-08
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.33E-01	4.76E-09	3.64E+00	1.73E-08	7.60E+04	4.58E-02	7.33E-02	2.63E-09	3.64E+00	9.58E-09
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	8.28E-01	2.97E-08	1.86E+00	5.53E-08	1.19E+06	4.47E+00	4.57E-01	1.64E-08	1.86E+00	3.05E-08
	1.54E+04			4.31E+02				4.80E-01		7.79E+02		4.37E-03		2.65E-01

Monitor conversion factor CF11 (uCi/cc-cpm) = 1.07E-02

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
5.14E-01	1.00E+02	4.80E+01	1.42E+00	5.00E+02	1.33E+02
2.57E-01	5.00E+01	2.40E+01	7.10E-01	2.50E+02	6.64E+01
5.14E+00	1.00E+03	4.80E+02	1.42E+01	5.00E+03	1.33E+03

2HVS-RMQ-301B Decon Building Vent:

Monitor efficiencies from ERS-SFL-86-026
2RMQ-RQI-301B

Upstream filtration (Iodines reduced 0.01)
Release Flow Rate = 1.24E+04 cfm : 5.85E+06 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 7.15E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 3.95E+04 (Expression 5)

Isotope	U2 only LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.63E+01	2.78E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.98E-01	1.53E-07	0.00E+00	0.00E+00
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.71E+01	1.15E-05	3.20E+07	3.67E+02	0.00E+00	0.00E+00	3.71E+00	6.33E-07	3.20E+07	2.03E+01
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.97E+05	6.78E-02	3.60E+07	2.44E+06	0.00E+00	0.00E+00	2.19E+04	3.74E-03	3.60E+07	1.35E+05
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	8.54E+00	1.46E-06	3.73E+07	5.44E+01	0.00E+00	0.00E+00	4.72E-01	8.06E-08	3.73E+07	3.01E+00
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.15E+00	7.30E+01	1.25E-05	3.05E+07	3.81E+02	0.00E+00	0.00E+00	4.03E+00	6.89E-07	3.05E+07	2.10E+01
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.54E-04	6.05E-11	3.72E+07	2.25E-03	0.00E+00	0.00E+00	1.96E-05	3.34E-12	3.72E+07	1.24E-04
Xe-131m	1.16E+00	2.00E-02	4.29E+01	8.59E-01	1.43E+04	2.45E-03	2.44E+07	5.97E+04	0.00E+00	0.00E+00	7.91E+02	1.35E-04	2.44E+07	3.30E+03
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	2.20E+03	3.75E-04	2.86E+07	1.07E+04	0.00E+00	0.00E+00	1.21E+02	2.07E-05	2.86E+07	5.93E+02
Xe-133	2.48E+01	4.21E-01	1.76E+02	7.41E+01	3.01E+05	5.14E-02	1.80E+07	9.25E+05	0.00E+00	0.00E+00	1.66E+04	2.84E-03	1.80E+07	5.11E+04
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.47E+02	2.51E-05	7.22E+06	1.81E+02	0.00E+00	0.00E+00	8.11E+00	1.39E-06	7.22E+06	1.00E+01
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.26E+02	3.85E-05	3.86E+07	1.49E+03	0.00E+00	0.00E+00	1.25E+01	2.13E-06	3.86E+07	8.21E+01
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-08	1.44E-03	2.47E-10	3.78E+07	9.32E-03	0.00E+00	0.00E+00	7.97E-05	1.36E-11	3.78E+07	5.15E-04
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.60E-01	2.74E-08	3.52E+07	9.64E-01	0.00E+00	0.00E+00	8.85E-03	1.51E-09	3.52E+07	5.32E-02
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	6.56E+01	1.12E-05	2.98E+05	3.34E+00	2.44E+07	2.24E+03	3.63E+00	6.19E-07	2.98E+05	1.84E-01
I-132	3.62E-03	6.14E-05	4.33E+04	2.66E+00	4.39E+01	7.50E-06	3.72E+05	2.79E+00	2.90E+05	1.78E+01	2.43E+00	4.14E-07	3.72E+05	1.54E-01
I-133	1.38E-03	2.34E-05	1.28E+05	3.00E+00	1.67E+01	2.86E-06	3.69E+05	1.05E+00	5.77E+06	1.35E+02	9.25E-01	1.58E-07	3.69E+05	5.82E-02
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	4.38E-01	7.48E-08	3.78E+05	2.82E-02	7.60E+04	4.66E-02	2.42E-02	4.13E-09	3.78E+05	1.56E-03
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.56E+00	7.79E-07	3.49E+05	2.72E-01	1.19E+06	7.59E+00	2.52E-01	4.31E-08	3.49E+05	1.50E-02
	5.89E+01			1.33E+02				3.44E+06		2.40E+03		6.75E-03		1.90E+05

Monitor conversion factor CF11 (uCi/cc-cpm) = 5.56E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
1.91E+01	1.00E+02	3.44E+08	5.28E+00	5.00E+02	9.50E+07
9.56E+00	5.00E+01	1.72E+08	2.64E+00	2.50E+02	4.75E+07
1.91E+02	1.00E+03	3.44E+09	5.28E+01	5.00E+03	9.50E+08

2HVS-RMQ-303B Waste Gas Tank Vault Vent:

Monitor efficiencies from ERS-SFL-88-026
2RMQ-RQI-303B

Upstream filtration (iodines reduced 0.01)
Release Flow Rate = 2.00E+03 cfm 9.44E+05 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 2.94E+05 (Expression 5)
Release (uCi/s) CF for Child Thyroid = #DIV/0! (Expression 5)

Isotope	U2 only GWS (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	3.18E+00	1.44E-03	4.69E-01	6.74E-04	4.23E+02	4.48E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	0.00E+00	#DIV/0!
Kr-85m	1.14E+01	5.15E-03	8.17E+02	4.21E+00	1.52E+03	1.61E-03	3.20E+07	5.14E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.20E+07	#DIV/0!
Kr-85	5.17E+02	2.34E-01	1.12E+01	2.62E+00	6.68E+04	7.28E-02	3.60E+07	2.62E+06	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.60E+07	#DIV/0!
Kr-87	6.71E+00	3.03E-03	4.47E+03	1.36E+01	8.92E+02	9.45E-04	3.73E+07	3.53E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.73E+07	#DIV/0!
Kr-88	2.20E+01	9.94E-03	1.13E+04	1.12E+02	2.93E+03	3.10E-03	3.05E+07	9.46E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.05E+07	#DIV/0!
Kr-89	2.39E-01	1.08E-04	1.02E+04	1.10E+00	3.18E+01	3.37E-05	3.72E+07	1.25E+03	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.72E+07	#DIV/0!
Xe-131m	1.98E+01	8.95E-03	4.29E+01	3.84E-01	2.63E+03	2.79E-03	2.44E+07	6.81E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.44E+07	#DIV/0!
Xe-133m	2.79E+01	1.26E-02	1.49E+02	1.88E+00	3.71E+03	3.93E-03	2.86E+07	1.12E+05	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.88E+07	#DIV/0!
Xe-133	1.50E+03	6.78E-01	1.76E+02	1.19E+02	1.99E+05	2.11E-01	1.80E+07	3.80E+06	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.80E+07	#DIV/0!
Xe-135m	3.80E+00	1.72E-03	2.15E+03	3.69E+00	5.05E+02	5.35E-04	7.22E+06	3.86E+03	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	7.22E+06	#DIV/0!
Xe-135	9.81E+01	4.43E-02	1.25E+03	5.54E+01	1.30E+04	1.38E-02	3.86E+07	5.33E+05	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.86E+07	#DIV/0!
Xe-137	6.30E-01	2.85E-04	9.55E+02	2.72E-01	8.38E+01	8.88E-05	3.78E+07	3.35E+03	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.78E+07	#DIV/0!
Xe-138	2.61E+00	1.18E-03	6.27E+03	7.39E+00	3.47E+02	3.68E-04	3.52E+07	1.29E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	3.52E+07	#DIV/0!
I-131	0.00E+00	0.00E+00	4.66E+05	0.00E+00	0.00E+00	0.00E+00	2.98E+05	0.00E+00	2.44E+07	0.00E+00	#DIV/0!	#DIV/0!	2.98E+05	#DIV/0!
I-132	0.00E+00	0.00E+00	4.33E+04	0.00E+00	0.00E+00	0.00E+00	3.72E+05	0.00E+00	2.90E+05	0.00E+00	#DIV/0!	#DIV/0!	3.72E+05	#DIV/0!
I-133	0.00E+00	0.00E+00	1.28E+05	0.00E+00	0.00E+00	0.00E+00	3.69E+05	0.00E+00	5.77E+06	0.00E+00	#DIV/0!	#DIV/0!	3.69E+05	#DIV/0!
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	3.78E+05	0.00E+00	7.60E+04	0.00E+00	#DIV/0!	#DIV/0!	3.78E+05	#DIV/0!
I-135	0.00E+00	0.00E+00	7.10E+04	0.00E+00	0.00E+00	0.00E+00	3.49E+05	0.00E+00	1.19E+06	0.00E+00	#DIV/0!	#DIV/0!	3.48E+05	#DIV/0!
	2.21E+03			3.22E+02				7.34E+06		0.00E+00		#DIV/0!		#DIV/0!

Monitor conversion factor CF11 (uCi/cc-cpm) = 2.79E-08

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
2.05E+01	1.00E+02	7.34E+08	#DIV/0!	5.00E+02	#DIV/0!
1.02E+01	5.00E+01	3.67E+08	#DIV/0!	2.50E+02	#DIV/0!
2.05E+02	1.00E+03	7.34E+09	#DIV/0!	5.00E+03	#DIV/0!

2MSS*RQI-101A,B,C Main Steam:

Monitor efficiencies from ERS-SFL-86-026

2MSS*RQI-101A,B,C — Release Flow Rate = 5.474E+03 cfm — 2.584E+06 cc/s

X/Q = 9.24E-05 s/m^3

Release (uCi/s) CF for TEDE = 5.31E+04 (Expression 5)

Release (uCi/s) CF for Child Thyroid = 2.63E+03 (Expression 5)

Isotope	U2 only SGTR (Ci)	Activity Ratio	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.87E+00	5.13E-04	4.69E-01	2.40E-04	2.72E+01	1.05E-05	0.00E+00	0.00E+00
Kr-85m	8.79E+00	1.57E-03	8.17E+02	1.28E+00	8.33E+01	3.23E-05	7.72E+03	2.49E-01
Kr-85	8.29E+02	1.48E-01	1.12E+01	1.66E+00	7.86E+03	3.04E-03	4.50E+01	1.37E-01
Kr-87	4.91E+00	8.77E-04	4.47E+03	3.92E+00	4.66E+01	1.80E-05	8.00E+03	1.44E-01
Kr-88	1.57E+01	2.80E-03	1.13E+04	3.17E+01	1.49E+02	5.76E-05	1.13E+04	6.51E-01
Kr-89	5.20E-02	9.29E-06	1.02E+04	9.47E-02	4.93E-01	1.91E-07	1.49E+04	2.84E-03
Xe-131m	3.42E+01	6.11E-03	4.29E+01	2.62E-01	3.24E+02	1.25E-04	1.74E+02	2.18E-02
Xe-133m	3.25E+01	5.80E-03	1.49E+02	8.65E-01	3.08E+02	1.19E-04	1.04E+03	1.24E-01
Xe-133	2.13E+03	3.80E-01	1.76E+02	6.70E+01	2.02E+04	7.82E-03	7.85E+01	6.14E-01
Xe-135m	2.11E+03	3.77E-01	2.15E+03	8.10E+02	2.00E+04	7.74E-03	8.36E+03	6.47E+01
Xe-135	4.07E+02	7.27E-02	1.25E+03	9.09E+01	3.86E+03	1.49E-03	9.74E+03	1.45E+01
Xe-137	1.57E-01	2.80E-05	9.55E+02	2.68E-02	1.49E+00	5.76E-07	3.56E+03	2.05E-03
Xe-138	1.56E+00	2.79E-04	6.27E+03	1.75E+00	1.48E+01	5.72E-08	1.15E+04	6.58E-02
I-131	5.94E+00	1.06E-03	4.66E+05	4.94E+02	5.63E+01	2.18E-05	1.07E+04	2.33E-01
I-132	2.04E+00	3.64E-04	4.33E+04	1.58E+01	1.83E+01	7.49E-06	2.90E+04	2.17E-01
I-133	8.76E+00	1.56E-03	1.28E+05	2.00E+02	8.31E+01	3.21E-05	1.06E+04	3.41E-01
I-134	9.49E-01	1.69E-04	2.69E+04	4.56E+00	9.00E+00	3.48E-06	2.86E+04	9.96E-02
I-135	4.84E+00	8.64E-04	7.10E+04	6.14E+01	4.59E+01	1.78E-05	1.18E+04	2.10E-01
	5.60E+03			1.79E+03				8.24E+01

Monitor conversion factor CF11 (uCi/cc-cpm) = 2.50E-04

Isotope	DCF ($mrem\text{-}m^3/uCi\text{-}y$)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	0.00E+00	0.00E+00	1.35E+00	5.22E-07	0.00E+00	0.00E+00
Kr-85m	0.00E+00	0.00E+00	4.13E+00	1.60E-06	7.72E+03	1.23E-02
Kr-85	0.00E+00	0.00E+00	3.89E+02	1.51E-04	4.50E+01	6.78E-03
Kr-87	0.00E+00	0.00E+00	2.31E+00	8.92E-07	8.00E+03	7.14E-03
Kr-88	0.00E+00	0.00E+00	7.37E+00	2.85E-06	1.13E+04	3.22E-02
Kr-89	0.00E+00	0.00E+00	2.44E-02	9.45E-09	1.49E+04	1.41E-04
Xe-131m	0.00E+00	0.00E+00	1.61E+01	6.22E-06	1.74E+02	1.08E-03
Xe-133m	0.00E+00	0.00E+00	1.53E+01	5.91E-06	1.04E+03	6.14E-03
Xe-133	0.00E+00	0.00E+00	1.00E+03	3.87E-04	7.85E+01	3.04E-02
Xe-135m	0.00E+00	0.00E+00	9.91E+02	3.83E-04	8.36E+03	3.21E+00
Xe-135	0.00E+00	0.00E+00	1.91E+02	7.40E-05	9.74E+03	7.20E-01
Xe-137	0.00E+00	0.00E+00	7.37E-02	2.85E-08	3.56E+03	1.02E-04
Xe-138	0.00E+00	0.00E+00	7.33E-01	2.84E-07	1.15E+04	3.26E-03
I-131	2.44E+07	2.59E+04	2.79E+00	1.08E-06	1.07E+04	1.16E-02
I-132	2.90E+05	1.06E+02	9.58E-01	3.71E-07	2.90E+04	1.08E-02
I-133	5.77E+06	9.03E+03	4.11E+00	1.59E-06	1.06E+04	1.69E-02
I-134	7.60E+04	1.29E+01	4.46E-01	1.72E-07	2.86E+04	4.93E-03
I-135	1.19E+06	1.03E+03	2.27E+00	8.80E-07	1.18E+04	1.04E-02
		3.61E+04		1.02E-03		4.08E+00

uCi/cc	TEDE	cpm
2.06E+00	1.00E+02	8.24E+03
1.03E+00	5.00E+01	4.12E+03
2.06E+01	1.00E+03	8.24E+04

uCi/cc	Child Thyroid	cpm
5.10E-01	5.00E+02	2.04E+03
2.55E-01	2.50E+02	1.02E+03
5.10E+00	5.00E+03	2.04E+04

This Addendum is added to calculate the Main Steam monitor EAL values using the release flow rate of 890,000 lbm/hr that was used in previous revision. This change was requested by Fleet ER, following discussion of the change made in Revision 6. It was felt that additional research was needed to determine and justify any change to the Revision 5 value before any new value is used. Consequently, the previous Revision 5 flow rate of 890,000 lbm/hr is used and the EAL value is recalculated in this Addendum. The calculations performed below do not differ from those performed in Revision 6, and are described earlier in this Technical Evaluation.

The main steam exhaust flow rate in cfm is calculated as follows:
The maximum release rate from an open main steam safety valve of 890,000 lbm/hr[1] at 1075 psig (1089.3 psia) is used at the basis for the main steam exhaust flow rate. The specific volume is 0.4051 ft^3/lb at saturation conditions.

$$6009\ ft^3/min = (890{,}000\ lb/hr) * (0.4051\ ft^3/lb) * (1\ hr/60\ min)$$

For use in the calculations, spreadsheet math is used to convert this to units of cc/s:

$$2.836E6\ cc/s = (6009\ ft^3/min) * (1\ min/60\ s) * (2.832E4\ cc/ft^3)$$

Using this revised flow rate, the Main Steam monitor EAL values are recalculated using all other input parameters and math identical to those used in Revision 6. The revised EAL values using the Revision 5 release flow rate of 890,000 lbm/hr are:

Main Steam:
2MSS*RQI-101A,B,C

	SAE	GE	
SGTR	1.88E+00	1.88E+01	TEDE
	4.65E-01	4.65E+00	THYROID
Minimum Value =	**4.65E-01**	**4.65E+00**	
2MSS*RQI-101A,B,C EFF			
Minimum Value =	**1.32E+06**	**1.32E+07**	

Addendum 1 References

1. Unit 2 UFSAR Section 10.3.3

2MSS*RQI-101A,B,C Main Steam:

Monitor efficiencies from ERS-SFL-88-026

2MSS*RQI-101A,B,C Release Flow Rate = 6.009E+03 cfm 2.836E+06 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 5.31E+04 (Expression 5)
Release (uCi/s) CF for Child Thyroid = 2.63E+03 (Expression 5)

Isotope	U2 only SGTR (Ci)	Activity Ratio	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)	DCF (mrem-m³/uCi-y)	Effective DCF	Release (uCi/s)	Release (uCi/cc)	Efficiency (cpm/uCi/cc)	Count Rate (cpm/mrem/h)
Kr-83m	2.87E+00	5.13E-04	4.69E-01	2.40E-04	2.72E+01	9.59E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.35E+00	4.75E-07	0.00E+00	0.00E+00
Kr-85m	8.79E+00	1.57E-03	8.17E+02	1.28E+00	8.33E+01	2.94E-05	7.72E+03	2.27E-01	0.00E+00	0.00E+00	4.13E+00	1.46E-06	7.72E+03	1.12E-02
Kr-85	8.29E+02	1.48E-01	1.12E+01	1.66E+00	7.86E+03	2.77E-03	4.50E+01	1.25E-01	0.00E+00	0.00E+00	3.89E+02	1.37E-04	4.50E+01	6.18E-03
Kr-87	4.91E+00	8.77E-04	4.47E+03	3.92E+00	4.66E+01	1.64E-05	8.00E+03	1.31E-01	0.00E+00	0.00E+00	2.31E+00	8.13E-07	8.00E+03	6.50E-03
Kr-88	1.57E+01	2.80E-03	1.13E+04	3.17E+01	1.49E+02	5.25E-05	1.13E+04	5.93E-01	0.00E+00	0.00E+00	7.37E+00	2.60E-06	1.13E+04	2.94E-02
Kr-89	5.20E-02	9.29E-06	1.02E+04	9.47E-02	4.93E-01	1.74E-07	1.49E+04	2.59E-03	0.00E+00	0.00E+00	2.44E-02	8.61E-09	1.49E+04	1.28E-04
Xe-131m	3.42E+01	6.11E-03	4.29E+01	2.62E-01	3.24E+02	1.14E-04	1.74E+02	1.99E-02	0.00E+00	0.00E+00	1.61E+01	5.66E-06	1.74E+02	9.85E-04
Xe-133m	3.25E+01	5.80E-03	1.49E+02	8.65E-01	3.08E+02	1.09E-04	1.04E+03	1.13E-01	0.00E+00	0.00E+00	1.53E+01	5.38E-06	1.04E+03	5.60E-03
Xe-133	2.13E+03	3.80E-01	1.76E+02	6.70E+01	2.02E+04	7.12E-03	7.85E+01	5.59E-01	0.00E+00	0.00E+00	1.00E+03	3.53E-04	7.85E+01	2.77E-02
Xe-135m	2.11E+03	3.77E-01	2.15E+03	8.10E+02	2.00E+04	7.05E-03	8.36E+03	5.80E+01	0.00E+00	0.00E+00	9.91E+02	3.49E-04	8.36E+03	2.82E+00
Xe-135	4.07E+02	7.27E-02	1.25E+03	9.09E+01	3.86E+03	1.36E-03	9.74E+03	1.33E+01	0.00E+00	0.00E+00	1.91E+02	6.74E-05	9.74E+03	6.56E-01
Xe-137	1.57E-01	2.80E-05	9.55E+02	2.68E-02	1.49E+00	5.25E-07	3.56E+03	1.87E-03	0.00E+00	0.00E+00	7.37E-02	2.60E-08	3.56E+03	9.25E-05
Xe-138	1.56E+00	2.79E-04	6.27E+03	1.75E+00	1.48E+01	5.21E-06	1.15E+04	6.00E-02	0.00E+00	0.00E+00	7.33E-01	2.58E-07	1.15E+04	2.97E-03
I-131	5.94E+00	1.06E-03	4.68E+05	4.94E+02	5.63E+01	1.99E-05	1.07E+04	2.12E-01	2.44E+07	2.59E+04	2.79E+00	9.83E-07	1.07E+04	1.05E-02
I-132	2.04E+00	3.64E-04	4.33E+04	1.58E+01	1.93E+01	6.82E-06	2.90E+04	1.98E-01	2.90E+05	1.06E+02	9.58E-01	3.38E-07	2.90E+04	9.79E-03
I-133	8.76E+00	1.56E-03	1.28E+05	2.00E+02	8.31E+01	2.93E-05	1.06E+04	3.10E-01	5.77E+06	9.03E+03	4.11E+00	1.45E-06	1.06E+04	1.54E-02
I-134	9.49E-01	1.69E-04	2.69E+04	4.56E+00	9.00E+00	3.17E-06	2.86E+04	9.07E-02	7.60E+04	1.29E+01	4.46E-01	1.57E-07	2.86E+04	4.49E-03
I-135	4.84E+00	8.64E-04	7.10E+04	6.14E+01	4.59E+01	1.62E-05	1.18E+04	1.91E-01	1.19E+06	1.03E+03	2.27E+00	8.01E-07	1.18E+04	9.46E-03
	5.60E+03			1.79E+03				7.51E+01		3.61E+04		9.27E-04		3.72E+00

Monitor conversion factor CF11 (uCi/cc-cpm) = 2.50E-04

uCi/cc	TEDE	cpm	uCi/cc	Child Thyroid	cpm
1.88E+00	1.00E+02	7.51E+03	4.65E-01	5.00E+02	1.86E+03
9.38E-01	5.00E+01	3.75E+03	2.32E-01	2.50E+02	9.29E+02
1.88E+01	1.00E+03	7.51E+04	4.65E+00	5.00E+03	1.86E+04

7. ERS-SFL-88-027, “Process Safety Limits, Alarm Setpoints and EAL Indicator Value for 2CHS-RQ101 A/B,” Revision 3

Beaver Valley Power Station

Radiation Protection Technical Position/Evaluation/Calculation

Subject	No.	PAGE 1 OF
Process Safety Limits, Alarm Setpoints and EAL Indicator Value for 2CHS-RQ101A/B	**ERS-SFL-88-027**	**13**

Reference
HPP______ EPP ______ T/S ______ CR ______ DCP______

Category

☐ Technical Position ☒ Technical Evaluation ☐ Calculation

Unit 1 ☐ Unit 2 ☒

Purpose

The purpose of this technical evaluation is to document the derivation of alarm setpoints for Unit 2 DRMS monitor 2CHS-RQ101A/B. Alarm setpoints were previously documented by SWEC 12241-UR(B)-410, Rev. 1. Also provided are revised database engineering unit conversion factors. Also the monitor indication (without consideration for instrument error) associated with an RCS activity concentration of 21 uCi/g is calculated.

☐ **ORIGINAL ISSUE**

☒ **REVISION # 3**

Revision description:

This revision adds the letdown radiation monitor indications that correspond to an RCS concentration equivalent to 21 uCi/g dose equivalent iodine-131 (DE I-131). This value is proposed for use as part of the NEI EAL (Emergency Action Level) upgrade project for EAL SU9. Updated references. Updated the source term/basis to use 12241-UR(B)-484 data.

by	checker/reviewer	independent review (calculation only)
John T. Lebda 8-10-11 date	Michael Unfried 8-10-2011 date	N/A - Not a Calculation date

Checklist

☒ Purpose
☒ Methodology
☒ Input Data
☒ Results
☒ References

Attachments

☒ Data Sheets
☐ Illustrations
☐ Printouts
☐ Code Listings

☒ Transmittal to BVRC
☒ Original RP ERF FILE
☐ MGR, Radiation Protection
☐ Supt, Rad Ops
☐ Supv, RP Services
☐ Supv, Rad Waste/Effluents
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Beaver Valley Power Station

Radiation Protection Technical Position/Evaluation/Calculation	REVISION: [redacted] 3	
Subject: **Process Safety Limits, Alarm Setpoints and EAL Indicator Value for 2CHS-RQ101A/B**	No.: ERS-SFL-88-027	Page: 2

PURPOSE

The purpose of this calculation is to determine the alarm setpoints (alert and high) for the Unit 2 letdown radiation monitor, CHS-RQ101A/B high range and low range channels. This revision incorporates changes necessary to reflect implementation of Unit 2 Technical Specification Amendment 101[1]. This Amendment lowers the reactor coolant system Technical Specification allowed activity limit which forms the basis for the monitor alarm setpoints. Also the monitor indication (without consideration for instrument error) associated with an RCS activity concentration of 21 uCi/g is calculated.

DISCUSSION

The basis for the CHS-101A/B alarm setpoints is discussed in the Unit 2 NRC SER section 4.2.4.2[2] which states "The reactor coolant letdown monitors – which include high- and low- range offline liquid monitors in the reactor coolant letdown line that can detect conditions that indicate fuel rod failure...". Further the Unit 2 UFSAR[3] Section 4.2.3.3 states "Provisions for detection of fuel rod failure include high- and low-range off-line liquid monitors in the reactor coolant letdown line as discussed in Section 11.5.2.5.10". UFSAR[4] Section 11.5.2.5.10 provides a general description of monitor configuration and function, but does not mention the alarm setpoints. These documents establish the licensing basis for the monitor and monitor alarm function. Note that the extent of fuel failure or any other specifics regarding the alarm setpoints is not mentioned.

Calculation History:
SWEC 12241 UR(B)-410-1 (1986)[5]
This calculation package initially provided high range monitor alarm safety limit values based on 1% failed fuel (high setpoint) and the Technical Specification RCS concentration limits (alert setpoint), and low range monitor alarm safety limit values based on expected RCS activity (high setpoint) and 0.05% failed fuel RCS concentration (alert setpoint). Revision 1 was made after it was discovered that, although there are two monitors, they feed a common alarm channel. Therefore, only one each of a high and an alert setpoint are possible. The revision 1 setpoints were based on the Technical Specification RCS concentration limits (48 hour action limit of 1.0 μCi/g DEI-131) for the high setpoint, and the alert setpoint was set at 75% of this value.

ERS-SFL-88-027-1 (1989)[6]
This calculation revised the monitor setpoints using updated monitor isotopic efficiencies. The previous SWEC calculations were performed using preliminary vendor calibration data. This calculation maintained the setpoint bases established in 12241-UR(B)-410, Rev. 1[5].

ERS-SFL-88-027-2 (1999)[21]
This revision was made to address source term changes resulting from Unit 2 Technical Specification Amendment 101[1]. This Amendment lowers the Technical Specification reactor coolant system (RCS) activity concentration limit from 1.0 μCi/g dose equivalent iodine 131 (DEI-131) to 0.35 μCi/g. Additionally, the basis for defining DEI-131 is changed to use dose conversion factors based on ICRP 26/30[7,8] and taken from Federal Guidance Report 11[9]. (These changes had been previously implemented at Unit 1[10].) Additionally, this calculation incorporates a recent update made to the design RCS activity concentrations[11,12].

This information is used to derive the revised Technical Specification reactor coolant system (RCS) activity concentration limit for each radioisotope. Also, this change has a significant impact on the calculated alarm setpoint and monitor conversion factor (CF11). The impacts are further discussed in the RESULTS section of this calculation package.

ERS-SFL-88-027, Rev. 3 (2011)
Added the letdown radiation monitor indications that correspond to an RCS concentration equivalent to 21 uCi/g dose equivalent iodine-131 (DE I-131). This value is proposed for use as part of the NEI EAL upgrade project for EAL SU9. Updated references. Updated the source term/basis to use 12241-UR(B)-484[19] data.

Comparison to Unit 1:
The Unit 1 letdown radiation monitors setpoints are based on an RCS activity concentration with 1% failed fuel[13]. The high-high alarm is set to actuate at an RCS concentration while operating with 1% failed fuel and the high alarm is set to actuate at an RCS concentration while operating with 0.5% failed fuel. These concentrations are much higher than the Technical Specification activity concentration limits. The difference between the two Units is apparently due to the SWEC analyst's decision to select the Technical Specification activity concentration limits as the setpoint basis (rather than the originally used 1% failed fuel) when revision 1 of 12241-UR(B)-410 was performed. Using this as the setpoint basis will cause the Unit 2 monitor to alarm with a lower amount of failed fuel as compared to that for Unit 1.

Because of the difference discussed above, a different methodology must be used to determine the activity concentrations between the Units. At Unit 1, with the setpoint based on activity concentration with 1% failed fuel, it was necessary to make adjustments in the source term to consider that additional RCS clean-up will occur when the letdown system is operated at a flow rate higher than 60 gpm, the value at which the design activity concentrations were calculated. A higher flow rate, normally approximately 105 gpm, is routine and this is taken into consideration in the alarm setpoint calculation. At Unit 2, using the Technical Specification activity concentration limit at the setpoint basis, any need to adjust for variation in activity removal is eliminated.

With regard to the proposed EAL monitor indication of 21 uCi/g, the only difference between Unit 1 (cpm) and Unit 2 (uCi/cc) is that the calculations are done to provide indication in the appropriate units.

METHODOLOGY

The methodology of this calculation is identical to that used in the previous revision. This RCS isotopic mix is assumed to be that calculated for the Technical Specification concentration limit. These values are then multiplied by the monitor efficiency specific to each radioisotope and the resulting count rates are summed to produce the monitor response. Because Technical Specification concentration is expressed in units of μCi/g and efficiency is expressed as cpm-cc/μCi this calculation corrects for density at the monitor. Finally, because the isotopic mix is updated, the monitor engineering unit conversion factors (CF11) are recalculated. All of the mathematical operations are provided in further detail on the Attachment 2 spreadsheets.

Instrument error is considered when determining the alarm trip setpoint. BVPS Unit 2 is committed to Regulatory Guide 1.105[14]. This document provides the basis for instrument setpoints for safety related systems, and is implemented through Radiological Engineering Administrative Manual procedure BVBP-RP-0002[15]. Therein, the Total Loop Uncertainty is defined as:

$$TLU = (EA^2 + PA^2 + CA^2 + SA^2 + DA^2 + +LA^2 + TA)^{0.5} \qquad \text{[eq. 1]}$$

And the Trip Setpoint as:

$$TSP = AL / [1 + (\%TLU / 100 + (\%DEADBAND) / 100] \qquad \text{[eq. 2]}$$

The TLU has previously been determined to equal 21%[16]. Because this value is derived elsewhere, the reader is referred to the source, and BVBP-RP-0002, for explanation of the variables in the error analysis equation.

The TSP is:

$$TSP = \frac{\text{Activity conc (AL) } (\mu Ci/cc)}{1 + (21\% / 100) + (10\% / 100)} = \frac{\text{Activity conc (AL) } (\mu Ci/cc)}{1.31} \qquad \text{[eq. 3]}$$

INPUT DATA AND ASSUMPTIONS

1. Reactor Coolant Technical Specification activity concentrations [19, Table 9.2]
2. Basis for Technical Specification activity = 0.35 μCi/g DEI-131 (48 hour limit) [1]
3. Proposed EAL monitor indication = 21 μCi/g DEI-131 (Technical Specification instantaneous limit) [1]
4. CHS-RQ-101A/B nuclide efficiencies (Nuclide efficiencies are listed in Attachments 1 & 2) [17]
5. Fluid temperature at CHS-101A/B = 130 °F [5]
6. Fluid density at CHS-101A/B = 61.6 lbm/ft^3 [5]
7. Fluid density – Standard = 62.43 lbm/ft^3 [Calculated]

   7.481 gal/ft^3 * 3785.3 cm^3/gal * 1 g/cm^3 / 453.592 g/lbm [18]
8. Instrument Error = ±21% [16]

RESULTS

For the high range monitor and the low range monitor (Attachment 2), the monitor response in cpm is calculated using activity concentrations at the (48 hour) Technical Specification limits. Because the RCS activities are given in μCi/g, only a slight density correction is necessary to determine the concentration in μCi/cc at the monitor. Consistent with the current analysis of record (and with Unit 1), the monitor response is calculated in terms of gross activity. That is, those isotopes that cause no monitor response are included. By employing this method, the monitor reading will represent total activity, even though some isotopes cannot be detected. Also, it is important to note that the monitor reading in μCi/cc represents the concentration at the monitor, and not in the RCS. Because of density differences, this difference is approximately 40%, with the actual concentration in the RCS being lower. The setpoint calculation is based on mass concentration rather than volume concentration, and is not affected by this fact.

From Attachment 2:
Note: The spreadsheet carries higher precision than shown below.

Technical Specification activity concentration = 4.97E+01 μCi/cc at the monitor. This is the analytical limit (AL), or process safety limit. Applying equation 3 to determine the high alarm trip set point (TSP):

4.11E+01 μCi/cc = the high alarm trip setpoint with instrument error adjustment (4.97E+01 μCi/cc / 1.31). This should be set with the background subtract feature active, or with the corresponding background added to the alarm setpoint.

and taking 75% of the high setpoint to calculated the alert alarm setpoint:

3.08E+01 μCi/cc = the alert alarm trip setpoint. This should be set with the background subtract feature active, or with the corresponding background added to the alarm setpoint.

> Note: Although there are two monitors (high range and low range) they both provide input to a single set of alarms (high alarm and alert alarm).

The corresponding high range monitor response = 1.38E+03 cpm / 4.97E+01 μCi/cc

The corresponding low range monitor response = 3.49E+05 cpm / 4.97E+01 μCi/cc

3.60E-02 μCi/cc-cpm = the high range monitor engineering unit conversion factor (CF11) (4.97E+01 μCi/cc / 1.38E+03 cpm)

1.43E-04 μCi/cc-cpm = the low range monitor engineering unit conversion factor (CF11) (4.97E+01 μCi/cc / 3.49E+05 cpm)

As compared to the current alarm setpoints, the values calculated herein are slightly higher. This is attributed to use of the revised term used in this revision. The influence of the revised source term was previously evaluated in 10080-UR(B)-508[20], and was judged to not be significant. Therefore no setpoint revision was made at that time. This technical evaluation does use the revised source term to calculate alarm setpoints, and the change is not significant as was assumed in 10080-UR(B)-508. This change will be communicated to Radiological Operations, however the current alarm setpoints appear appropriate with not obvious change needed. If the revised alarm setpoints are used, then the revised CF11 values will also need to be used.

Predicted monitor cpm at maximum Technical Specification activity concentrations:

	Current cpm	Rev. 3 cpm
High range	1.35E+03	1.38E+03
Low range	3.45E+05	3.49E+05

The monitor engineering unit conversion factors (CF11):

	Current µCi/cc-cpm	Rev, 3 µCi/cc-cpm
High range	3.68E-02	3.60E-02
Low range	1.44E-04	1.43E-04

The monitor alarm setpoint values:

	Current µCi/cc	Rev. 3 µCi/cc
High	38.0	41.1
Alert	28.5	30.8

The calculated monitor indication that corresponds to an RCS activity concentration of 21 uCi/g is 2.98E+03 uCi/cc for the high range channel. Note that this is a proposed EAL value and does not include instrument error consideration. This value is "offscale" with the low range monitor (range of 1.43E-3 to 1.43E+3 uCi/cc), so no EAL value is applicable to the low range monitor.

REFERENCES

1. Unit 2 Technical Specification Amendment 101, Docket No. 50-412, 1999
2. Unit 2 NRC SER Chapter 4, Section 4.2.4.2, Online Fuel System Monitoring
3. Unit 2 UFSAR Chapter 4, Section 4.2.3.3, Fuel Rod Performance
4. Unit 2 UFSAR Chapter 11, Section 11.5.2.5.10, Reactor Coolant Letdown Monitor (High and Low Range)
5. SWEC Calculation 12241 UR(B)-410-1, Determine the Safety Limits for the Reactor Coolant Letdown High Range and Low Range Monitor 2CHS-RQI-101A & B, 1987
6. Calculation ERS-SFL-88-027 Rev. 1, Process Safety Limits and Alarm Setpoints for 2CHS-RQ101 A/B, 1989
7. ICRP Publication 26, Recommendations of the International Commission on Radiological Protection, Pergamon Press, New York, Reprinted 1981
8. ICRP Publication 30, Limits for Intakes of Radionuclides by Workers, Pergamon Press, New York, 1978
9. Federal Guidance Report 11. Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion, US EPA 521/1-88-020, 1988
10. Unit 1 Technical Specification Amendment 205, Docket No. 50-334, 1997
11. SWEC Calculation 12241 UR(B)-478, Design Reactor Core Inventory (3.96% Initial Enrichment) and Associated Equilibrium Primary and Secondary Coolant Activities for BVPS, 1999
12. SWEC Calculation 12241 UR(B)-479, Radiological Source Term for Accident Analyses – Composite Equilibrium Reactor Core Inventory (3.6% - 7% Initial Enrichment) and Associated Design Primary and Secondary Coolant Activities for BVPS, 1999
13. Calculation ERS-JTL-99-005, Unit 1 Letdown Radiation Monitor (RM-1CH-101) Alarm Setpoint Calculation, 1999
14. US NRC Regulatory Guide 1.105, Instrument Setpoints, Revision 1, 1976
15. BVBP-RP-0002, Radiation Monitor Alarm Setpoint Determination
16. SWEC Calculation 12241 UR(B)-432-2, Trip Setpoint Calculation for 8 Radiation Monitors Associated with DRMS Communication Loop #1, 1987
17. Calculation ERS-SFL-86-026, r9, Unit 2 DRMS Isotopic Efficiencies, 1995
18. The Health Physics and Radiological Health Handbook, Shleien, B., Scinta, Inc, Silver Spring, Revised Edition, 1992
19. SWEC Calculation 10080-UR(B)-484, Primary and Secondary Design/Technical Specification Activity Concentrations Including Pre-Accident Iodine Spike Concentrations and Equilibrium Iodine Appearance Rates Following Power Uprate, 200299
20. SWEC Calculation 10080-UR(B)-508, Impact of Atmospheric Containment Conversion, Power Uprate, and Alternative Source Terms on the Alarm Setpoints for the Radiation Monitors at BVPS2
21. Calculation ERS-SFL-88-027 Rev. 2, Process Safety Limits and Alarm Setpoints for 2CHS-RQ101 A/B, 1999

Alarm Setpoint Methodology

DISCUSSION

This appendix describes the bases for the alarm setpoint methodology. Only increasing value alarm setpoints are addressed. A similar methodology could be described for decreasing value alarm setpoints, but these are not applicable to radiation monitoring.

USNRC Regulatory Guide 1.105, Instrument Setpoints [1], provides a regulatory position on setpoints on systems important to safety. The guide provides the following definition of "systems important to safety":

> *"...those systems that are necessary to ensure (1) the integrity of the reactor coolant pressure boundary, (2) the capability to shutdown the reactor and maintain it in a safe condition, or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guideline exposures of 10 CFR Part 100, Reactor Site Criteria...."*

The BVPS Unit 2 UFSAR [2] contains a commitment to this regulatory guide, but the referenced discussion in section 7 of the UFSAR does not specifically address radiation monitors. SWEC addressed RG 1.105 in the development of Unit 2 category 1 radiation monitor setpoints. This issue was addressed by the Radiation Safety Committee in meeting 25-87[3] and a position paper was prepared on this issue [4]. While recognizing the need to consider instrument errors in determining alarm setpoints, this position paper concluded that the regulatory guide was (1) applicable to a subset of the Unit 2 monitors, (2) applicable to only those Unit 1 monitors installed in response to a Unit 2 licensing commitment, and (3) not applicable to effluent monitors (ODCM). This position paper was accepted by the RSC (BV-RSC-27-87) and approved by the OSC (BV-OSC-48-87).

Regulatory Guide 1.105 provides, in part:

> *"...The setpoints should be established with sufficient margin between the technical specification limits for the process variable and the nominal trip setpoint to allow for (a) the inaccuracy of the instrument; (b) uncertainties in the calibration, and (c) the instrument drift that could occur during the interval between calibrations...."*

The methodology employed by SWEC was, as was this appendix, based on ANSI/ISA-S67.04-1988, Setpoints for Nuclear Safety-Related Instrumentation [5], which provides a means to accomplish the above.

DEFINITIONS

Safety Limit [SL] A limit on an important process variable that is necessary to reasonably protect the integrity of the physical barriers that guard against uncontrolled release of radioactivity [5]. Safety limits are documented in the UFSAR, in technical specification bases, and in other design basis documentation.

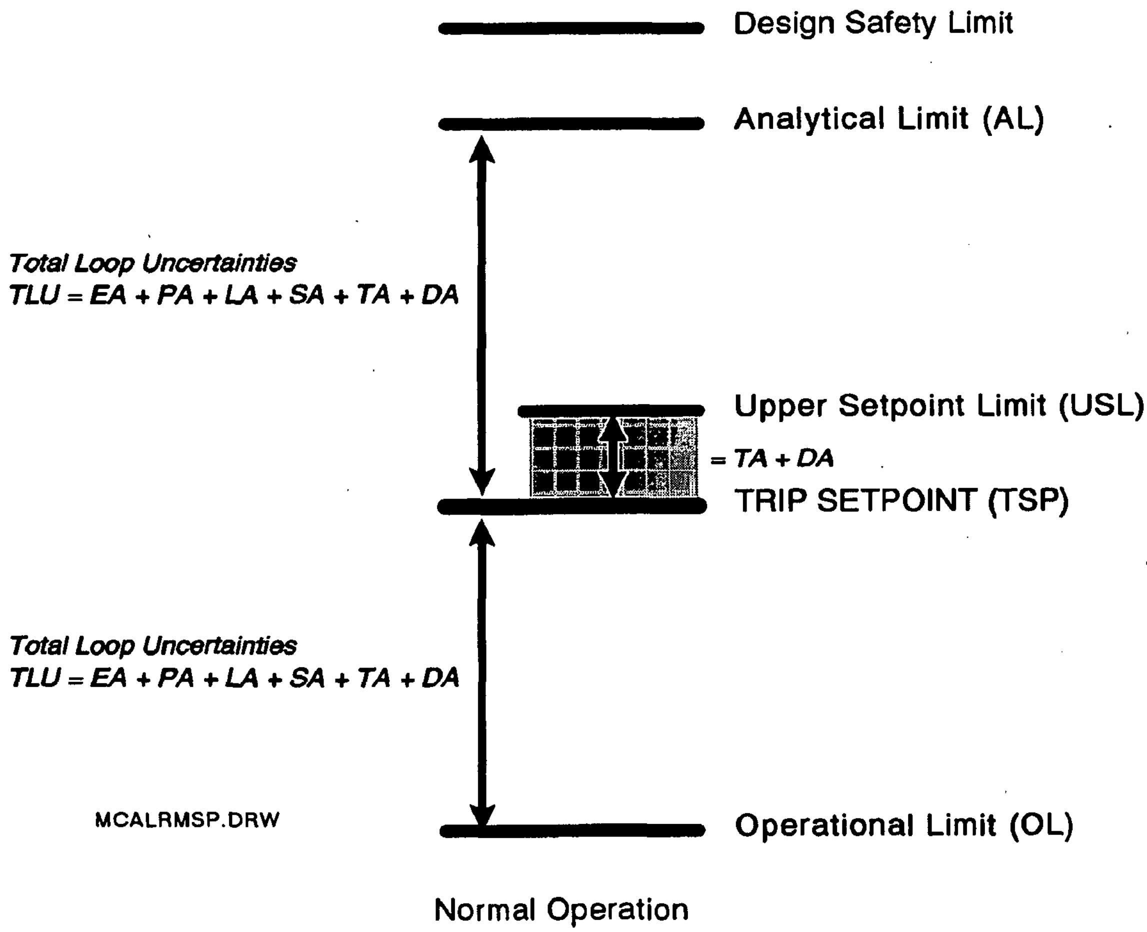
Analytical Limit [AL] Limit of a measured or calculated variable established by safety analyses to ensure that a safety limit is not exceeded [5]. The difference between a safety limit and an analytical limit provides margin to account for process dependent effects such as (but not limited to) process delays, emergency diesel generator sequencing, valve or damper closure times, and instrument response times.

Trip Setpoint [TSP] A predetermined value [of the monitored parameter] at which a bistable device changes state to indicate that the quantity under surveillance has reached the selected value [5]. The difference between a trip setpoint and an analytical limit is the allowance provided to account for instrument uncertainty, instrument calibration uncertainty (and, if not addressed in the determination of analytical limit, process dependent effects).

Upper Setpoint Limit [USL] A predetermined value of the monitored parameter above the trip setpoint that, if exceeded during periodic surveillance testing, indicates unsatisfactory instrument performance. The band defined between the trip setpoint and the upper setpoint limit is the allowance provided to account for instrument uncertainties such as setpoint drift, power supply drift, random response variation, deadband, etc.

Operational Limit [OL] The maximum value that the monitored parameter may attain during normal operations, based on administrative controls, that will not result in the occurrence of an alarm.

These quantities are illustrated on the figure below.



DETERMINATION OF ALLOWANCES

Environmental Allowance [EA] Includes the effects of radiation, temperature, pressure, humidity, chemical sprays on the instrumentation. EA should be determined for all safety related monitors expected to operate under accident conditions if the instrument vendor has indicated an accuracy under these conditions that differs from the accuracy expressed for operation under normal conditions. Applies only to QA Category 1 monitors.

Leakage Allowance [LA] Includes instrument signal losses due to cable or penetration leakage or impedence. Applies only to QA Category 1 monitors.

Process Allowance [PA] Includes effects associated with the measurement of the process parameter (e.g., sample line plateout, isokinetic sampling), errors associated with calculation of the process parameter by indirect measurements (e.g., determining flow from Dp measurements).

Calibration Allowance [CA] Includes errors associated with calibrations of the sensor and the readout rack, such as those related to the calibration standard, equipment, and method.

Sensor Allowance [SA] Includes errors associated with the sensor and readout accuracy. Considerations include: linearity; deadtime; energy response linearity; repeatability; power supply stability; temperature, pressure, and humidity changes; ADC/DAC errors, etc.

Drift Allowance [DA] Includes errors due to undesired changes in instrument response, over a period of time, that are independent of the instrument input or use environment. The period of time is normalized to the period between instrument calibrations or surveillance testing.

Tolerance Allowance [TA] Includes administrative tolerances allowed for calibration and/or setpoint adjustment (e.g., adjust to within ± xx% of xxxx cpm).

The errors addressed by these allowances may be dependent or independent. Dependent errors are summed algebraically. Independent errors are summed using the root-of-squared-sums method. Prior to summing, all errors are normalized to a common base (e.g., percent of span, percent of full scale). Unit 1 calibration MSPs provide a tolerance of ±10%. Unit 2 calibration MSPs provide a tolerance of ±15%.

Not all of these allowances are applicable to a particular monitor -- only those applicable are considered. Dependent errors (e.g., LA, CP), are not addressed explicitly if it is reasonable to conclude that sensor-to-readout (end-to-end) calibrations adequately compensate for these effects. In cases where one allowance envelopes a related allowance, only the most restrictive allowance is summed. For example, an instrument setpoint accuracy (i.e., SA) of ±1% is considered enveloped by a tolerance allowance (TA) of ±10%.

The total instrument loop uncertainty (TLU) is the sum of the individual allowances. Assuming LA, to be dependent, and the remainder to be independent:

TLU = LA ± SQRT(EA2 + PA2 + CA2 + SA2 + DA 2+ TA 2)

The trip setpoint equals:

NOTE: In the following, %+TLU refers to the total loop uncertainty in the under-response direction expressed in percent. %-TLU refers to the total loop uncertainty in the over-response direction expressed in percent.

TSP = AL - (TLU x TSP)

TSP = AL / [1 + (%-TLU) /100]

The upper setpoint limit (USL) (NOTE: See definition above.):

USL = TSP + (TSPxDA) + (TSPxTA)

USL = TSP[1 + SQRT(DA2 + TA2)]

The operational limit (OL):

OL = TSP - (TLUxTSP)

OL = TSP[1- (%-TLU/100)]

1. USNRC, Instrument Setpoints, Regulatory Guide 1.105, USGPO ,11/76
2. BVPS Unit 2 Updated Safety Analysis Report, 1990
3. Minutes of Radiation Safety Committee Meeting 25-87
4. Applicability of RG1.105 to BVPS Radiation Monitors, ERS-SFL-87-036, 1987
5. ISA, Setpoints for Nuclear Safety-Related Instrumentation, ANSI/ISA-S67.04-1988
6. Ficke, R, Instrument Setpoint Calculations, presentation at Sorrento Electronics DRMS User's Group Meeting, Fall, 1990

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	A	B	C	D	E	F	G	H	I	J	K	L	M
1	CHS-101A/B Low Range Configuration High Alarm Setpoint and CF11.												
2		T. S. Max.	*Density Corr	T. S. Max.	Efficiency				T. S. Max.	*Density Corr	T. S. Max.	Efficiency	
3		(uCi/g)	(g/cc)	(uCi/cc)	(cpm-cc/uCi)	(cpm)			(uCi/g)	(g/cc)	(uCi/cc)	(cpm-cc/uCi)	(cpm)
4	Kr-83m	3.89E-02	0.9867	3.84E-02	0.000E+00	0.00E+00		Sr-92	9.79E-05	0.9867	9.66E-05	7.921E+04	7.65E+00
5	Kr-85	1.18E+01	0.9867	1.16E+01	0.000E+00	0.00E+00		Y-90	5.64E-06	0.9867	5.56E-06	0.000E+00	0.00E+00
6	Kr-85m	1.35E-01	0.9867	1.33E-01	0.000E+00	0.00E+00		Y-90m	0.00E+00	0.9867	0.00E+00	3.535E+02	0.00E+00
7	Kr-87	9.00E-02	0.9867	8.88E-02	2.718E+04	2.41E+03		Y-91	4.54E-05	0.9867	4.48E-05	2.515E+02	1.13E-02
8	Kr-88	2.52E-01	0.9867	2.49E-01	8.093E+04	2.01E+04		Y-91m	7.51E-05	0.9867	7.41E-05	0.000E+00	0.00E+00
9	Kr-89	7.25E-03	0.9867	7.15E-03	8.275E+04	5.92E+02		Y-92	8.40E-05	0.9867	8.29E-05	1.916E+04	1.59E+00
10	Kr-90	0.00E+00	0.9867	0.00E+00	6.292E+04	0.00E+00		Zr-95	6.00E-05	0.9867	5.92E-05	1.043E+05	6.17E+00
11	Xe-131m	4.84E-01	0.9867	4.78E-01	0.000E+00	0.00E+00		Nb-95	6.09E-05	0.9867	6.01E-05	1.032E+05	6.20E+00
12	Xe-133	2.95E+01	0.9867	2.91E+01	0.000E+00	0.00E+00		Mo-99	7.24E-02	0.9867	7.14E-02	1.852E+04	1.32E+03
13	Xe-133m	3.99E-01	0.9867	3.94E-01	0.000E+00	0.00E+00		Tc-99	0.00E+00	0.9867	0.00E+00	0.000E+00	0.00E+00
14	Xe-135	9.16E-01	0.9867	9.04E-01	3.686E+03	3.33E+03		Tc-99m	3.88E-02	0.9867	3.83E-02	0.000E+00	0.00E+00
15	Xe-135m	9.09E-02	0.9867	8.97E-02	0.000E+00	0.00E+00		Ru-103	5.67E-05	0.9867	5.59E-05	6.669E+03	3.73E-01
16	Xe-137	1.88E-02	0.9867	1.85E-02	2.734E+03	5.07E+01		Ru-106	2.10E-05	0.9867	2.07E-05	0.000E+00	0.00E+00
17	Xe-138	6.36E-02	0.9867	6.28E-02	3.957E+04	2.48E+03		Rh-106	2.33E-05	0.9867	2.30E-05	1.522E+04	3.50E-01
18	I-131	2.74E-01	0.9867	2.70E-01	1.060E+04	2.87E+03		Ag-110m	0.00E+00	0.9867	0.00E+00	3.188E+05	0.00E+00
19	I-132	1.08E-01	0.9867	1.07E-01	2.831E+05	3.02E+04		Sb-124	0.00E+00	0.9867	0.00E+00	1.966E+05	0.00E+00
20	I-133	4.10E-01	0.9867	4.05E-01	1.316E+04	5.32E+03		Te-125m	4.20E-05	0.9867	4.14E-05	0.000E+00	0.00E+00
21	I-134	6.00E-02	0.9867	5.92E-02	2.461E+05	1.46E+04		Te-127	1.11E-03	0.9867	1.10E-03	0.000E+00	0.00E+00
22	I-135	2.36E-01	0.9867	2.33E-01	9.640E+04	2.24E+04		Te-129	1.35E-03	0.9867	1.33E-03	1.154E+03	1.54E+00
23	H-3	3.50E+00	0.9867	3.45E+00	0.000E+00	0.00E+00		Te-129m	1.37E-03	0.9867	1.35E-03	4.723E+03	6.38E+00
24	C-14	0.00E+00	0.9867	0.00E+00	0.000E+00	0.00E+00		Te-131	1.23E-03	0.9867	1.21E-03	2.143E+04	2.60E+01
25	Ar-41	0.00E+00	0.9867	0.00E+00	8.154E+04	0.00E+00		Te-131m	3.42E-03	0.9867	3.37E-03	1.365E+05	4.61E+02
26	Cr-51	9.30E-03	0.9867	9.18E-03	0.000E+00	0.00E+00		Te-132	2.85E-02	0.9867	2.81E-02	0.000E+00	0.00E+00
27	Mn-54	4.80E-03	0.9867	4.74E-03	9.833E+04	4.66E+02		Te-133	8.32E-04	0.9867	8.21E-04	4.605E+04	3.78E+01
28	Mn-56	0.00E+00	0.9867	0.00E+00	1.301E+05	0.00E+00		Te-133m	1.85E-03	0.9867	1.83E-03	2.037E+05	3.72E+02
29	Fe-55	3.60E-03	0.9867	3.55E-03	0.000E+00	0.00E+00		Te-134	2.84E-03	0.9867	2.80E-03	5.890E+04	1.65E+02
30	Fe-59	9.00E-04	0.9867	8.88E-04	8.444E+04	7.50E+01		Cs-134	5.74E-01	0.9867	5.66E-01	2.169E+05	1.23E+05
31	Co-57	0.00E+00	0.9867	0.00E+00	1.759E+02	0.00E+00		Cs-134m	4.19E-03	0.9867	4.13E-03	0.000E+00	0.00E+00
32	Co-58	1.38E-02	0.9867	1.36E-02	1.006E+05	1.37E+03		Cs-135	0.00E+00	0.9867	0.00E+00	0.000E+00	0.00E+00
33	Co-58m	0.00E+00	0.9867	0.00E+00	0.000E+00	0.00E+00		Cs-136	1.42E-01	0.9867	1.40E-01	1.860E+05	2.61E+04
34	Co-60	1.59E-03	0.9867	1.57E-03	1.662E+05	2.61E+02		Cs-137	3.60E-01	0.9867	3.55E-01	9.631E+04	3.42E+04
35	Co-60m	0.00E+00	0.9867	0.00E+00	2.039E+02	0.00E+00		Ba-137m	3.41E-01	0.9867	3.36E-01	1.018E+05	3.43E+04
36	Ni-65	0.00E+00	0.9867	0.00E+00	3.254E+04	0.00E+00		Ba-139	7.57E-03	0.9867	7.47E-03	3.124E+02	2.33E+00
37	Cu-64	0.00E+00	0.9867	0.00E+00	3.988E+02	0.00E+00		Ba-140	3.89E-04	0.9867	3.84E-04	0.000E+00	0.00E+00
38	Zn-65	1.53E-03	0.9867	1.51E-03	4.364E+04	6.59E+01		La-140	1.34E-04	0.9867	1.32E-04	1.221E+05	1.61E+01
39	Br-83	7.17E-03	0.9867	7.07E-03	0.000E+00	0.00E+00		Ce-141	5.87E-05	0.9867	5.79E-05	0.000E+00	0.00E+00
40	Br-84	3.55E-03	0.9867	3.50E-03	9.626E+04	3.37E+02		Ce-143	4.33E-05	0.9867	4.27E-05	1.367E+04	5.84E-01
41	Br-85	3.75E-04	0.9867	3.70E-04	6.924E+03	2.56E+00		Ce-144	4.45E-05	0.9867	4.39E-05	0.000E+00	0.00E+00
42	Rb-88	2.62E-01	0.9867	2.59E-01	3.352E+04	8.67E+03		Pr-143	5.46E-05	0.9867	5.39E-05	1.264E-03	6.81E-08
43	Rb-89	1.49E-02	0.9867	1.47E-02	1.322E+05	1.94E+03		Pr-144	4.48E-05	0.9867	4.42E-05	2.481E+03	1.09E-01
44	Rb-90	1.16E-03	0.9867	1.14E-03	7.616E+04	8.72E+01		Np-239	6.60E-03	0.9867	6.51E-03	0.000E+00	0.00E+00
45	Sr-89	3.31E-04	0.9867	3.27E-04	1.410E+01	4.61E-03		Cs-138	9.76E-02	0.9867	9.63E-02	1.177E+05	1.13E+04
46	Sr-91	1.37E-04	0.9867	1.35E-04	7.623E+04	1.03E+01		Te-127m	3.20E-04	0.9867	3.16E-04	1.291E+01	4.08E-03
47		4.87E+01		4.81E+01		1.18E+05			1.69E+00		1.67E+00		2.31E+05
48									5.04E+01	- TOTALS -	4.97E+01	- TOTALS -	3.49E+05
49									uCi/g RCS	uCi/cc @ 130 degF			cpm

50 *Density correction = 0.9867 g/cc (based on letdown temperature of 130 degrees F)

51

52 Col B & I values from 12241-UR(B)-484 Table 9.2 — Col D = Col B * Col C ; Col K = Col I * Col J

53 Col C & J = 61.6 lbm/ft³ @130 degF / 62.43 lbm/ft³ standard = 0.9867 — Col E & L values from ERS-SFL-86-026 r3

54 Col F = Col D * Col E ; Col M = Col K * Col L

55

56

57 CF11 calculation: CF11 = at-monitor activity at T.S. limit (uCi/cc) / monitor count rate with RCS at T.S. limit (cpm)

58 CF11 = 4.97E+01 / 3.49E+05 = 1.43E-04 uCi/cc-cpm

59 uCi/cc @ 130 degF cpm

60

61 cpm uCi/cc-cpm uCi/cc

62 Monitor Indication @0.35 uCi/g DE I-131 = 3.49E+05 x 1.43E-04 = 4.97E+01

63 High alarm trip setpoint (indication with 21% instrument error included) = 4.11E+01

64 Alert alarm trip setpoint (75% of the High setpoint with 21% instrument error included) = 3.08E+01

65 Monitor Indication @21 uCi/g DE I-131 (4.66E+01 * (21 / 0.35) = 2.98E+03

66

67 Note: Higher precision than shown is carried through the calculation.

Note: The isotopes used are consistent with the original calculation and not all of the isotopes in UR(B)-484 are included.

Beaver Valley Power Station

Radiation Protection Technical Position/Evaluation/Calculation	REVISION: [redacted] 3	
Subject: **Process Safety Limits, Alarm Setpoints and EAL Indicator Value for 2CHS-RQ101A/B**	No.: ERS-SFL-88-027 **Attachment 2**	Page: 13

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	CHS-101A/B High Range Configuration High Alarm Setpoint and CF11.												
2		T. S. Max.	*Density Corr	T. S. Max.	Efficiency				T. S. Max.	*Density Corr	T. S. Max.	Efficiency	
3		(uCi/g)	(g/cc)	(uCi/cc)	(cpm-cc/uCi)	(cpm)			(uCi/g)	(g/cc)	(uCi/cc)	(cpm-cc/uCi)	(cpm)
4	Kr-83m	3.89E-02	0.9867	3.84E-02	0.000E+00	0.00E+00		Sr-92	9.79E-05	0.9867	9.66E-05	4.578E+02	4.42E-02
5	Kr-85	1.18E+01	0.9867	1.16E+01	0.000E+00	0.00E+00		Y-90	5.64E-06	0.9867	5.56E-06	0.000E+00	0.00E+00
6	Kr-85m	1.35E-01	0.9867	1.33E-01	0.000E+00	0.00E+00		Y-90m	0.00E+00	0.9867	0.00E+00	1.125E+00	0.00E+00
7	Kr-87	9.00E-02	0.9867	8.88E-02	1.496E+02	1.33E+01		Y-91	4.54E-05	0.9867	4.48E-05	1.481E+00	6.63E-05
8	Kr-88	2.52E-01	0.9867	2.49E-01	4.722E+02	1.17E+02		Y-91m	7.51E-05	0.9867	7.41E-05	0.000E+00	0.00E+00
9	Kr-89	7.25E-03	0.9867	7.15E-03	4.471E+02	3.20E+00		Y-92	8.40E-05	0.9867	8.29E-05	9.876E+01	8.19E-03
10	Kr-90	0.00E+00	0.9867	0.00E+00	3.538E+02	0.00E+00		Zr-95	6.00E-05	0.9867	5.92E-05	3.826E+02	2.27E-02
11	Xe-131m	4.84E-01	0.9867	4.78E-01	0.000E+00	0.00E+00		Nb-95	6.09E-05	0.9867	6.01E-05	3.977E+02	2.39E-02
12	Xe-133	2.95E+01	0.9867	2.91E+01	0.000E+00	0.00E+00		Mo-99	7.24E-02	0.9867	7.14E-02	6.889E+01	4.92E+00
13	Xe-133m	3.99E-01	0.9867	3.94E-01	0.000E+00	0.00E+00		Tc-99	0.00E+00	0.9867	0.00E+00	0.000E+00	0.00E+00
14	Xe-135	9.16E-01	0.9867	9.04E-01	9.664E+00	8.73E+00		Tc-99m	3.88E-02	0.9867	3.83E-02	0.000E+00	0.00E+00
15	Xe-135m	9.09E-02	0.9867	8.97E-02	0.000E+00	0.00E+00		Ru-103	5.67E-05	0.9867	5.59E-05	1.734E+01	9.70E-04
16	Xe-137	1.88E-02	0.9867	1.85E-02	1.525E+01	2.83E-01		Ru-106	2.10E-05	0.9867	2.07E-05	0.000E+00	0.00E+00
17	Xe-138	6.36E-02	0.9867	6.28E-02	2.359E+02	1.48E+01		Rh-106	2.33E-05	0.9867	2.30E-05	4.900E+01	1.13E-03
18	I-131	2.74E-01	0.9867	2.70E-01	3.120E+01	8.44E+00		Ag-110m	0.00E+00	0.9867	0.00E+00	1.276E+03	0.00E+00
19	I-132	1.08E-01	0.9867	1.07E-01	1.046E+03	1.11E+02		Sb-124	0.00E+00	0.9867	0.00E+00	7.016E+02	0.00E+00
20	I-133	4.10E-01	0.9867	4.05E-01	6.093E+01	2.46E+01		Te-125m	4.20E-05	0.9867	4.14E-05	0.000E+00	0.00E+00
21	I-134	6.00E-02	0.9867	5.92E-02	1.129E+03	6.68E+01		Te-127	1.11E-03	0.9867	1.10E-03	0.000E+00	0.00E+00
22	I-135	2.36E-01	0.9867	2.33E-01	5.492E+02	1.28E+02		Te-129	1.35E-03	0.9867	1.33E-03	5.112E+00	6.81E-03
23	H-3	3.50E+00	0.9867	3.45E+00	0.000E+00	0.00E+00		Te-129m	1.37E-03	0.9867	1.35E-03	1.591E+01	2.15E-02
24	C-14	0.00E+00	0.9867	0.00E+00	0.000E+00	0.00E+00		Te-131	1.23E-03	0.9867	1.21E-03	9.294E+01	1.13E-01
25	Ar-41	0.00E+00	0.9867	0.00E+00	4.824E+02	0.00E+00		Te-131m	3.42E-03	0.9867	3.37E-03	5.995E+02	2.02E+00
26	Cr-51	9.30E-03	0.9867	9.18E-03	0.000E+00	0.00E+00		Te-132	2.85E-02	0.9867	2.81E-02	0.000E+00	0.00E+00
27	Mn-54	4.80E-03	0.9867	4.74E-03	4.294E+02	2.03E+00		Te-133	8.32E-04	0.9867	8.21E-04	2.301E+02	1.89E-01
28	Mn-56	0.00E+00	0.9867	0.00E+00	6.348E+02	0.00E+00		Te-133m	1.85E-03	0.9867	1.83E-03	9.227E+02	1.68E+00
29	Fe-55	3.60E-03	0.9867	3.55E-03	0.000E+00	0.00E+00		Te-134	2.84E-03	0.9867	2.80E-03	2.219E+02	6.22E-01
30	Fe-59	9.00E-04	0.9867	8.88E-04	4.887E+02	4.34E-01		Cs-134	5.74E-01	0.9867	5.66E-01	7.155E+02	4.05E+02
31	Co-57	0.00E+00	0.9867	0.00E+00	5.743E-01	0.00E+00		Cs-134m	4.19E-03	0.9867	4.13E-03	0.000E+00	0.00E+00
32	Co-58	1.38E-02	0.9867	1.36E-02	4.227E+02	5.76E+00		Cs-135	0.00E+00	0.9867	0.00E+00	0.000E+00	0.00E+00
33	Co-58m	0.00E+00	0.9867	0.00E+00	0.000E+00	0.00E+00		Cs-136	1.42E-01	0.9867	1.40E-01	9.073E+02	1.27E+02
34	Co-60	1.59E-03	0.9867	1.57E-03	9.753E+02	1.53E+00		Cs-137	3.60E-01	0.9867	3.55E-01	2.906E+02	1.03E+02
35	Co-60m	0.00E+00	0.9867	0.00E+00	1.195E+00	0.00E+00		Ba-137m	3.41E-01	0.9867	3.36E-01	3.072E+02	1.03E+02
36	Ni-65	0.00E+00	0.9867	0.00E+00	1.885E+02	0.00E+00		Ba-139	7.57E-03	0.9867	7.47E-03	1.828E+00	1.37E-02
37	Cu-64	0.00E+00	0.9867	0.00E+00	2.345E+00	0.00E+00		Ba-140	3.89E-04	0.9867	3.84E-04	0.000E+00	0.00E+00
38	Zn-65	1.53E-03	0.9867	1.51E-03	2.503E+02	3.78E-01		La-140	1.34E-04	0.9867	1.32E-04	6.601E+02	8.73E-02
39	Br-83	7.17E-03	0.9867	7.07E-03	0.000E+00	0.00E+00		Ce-141	5.87E-05	0.9867	5.79E-05	0.000E+00	0.00E+00
40	Br-84	3.55E-03	0.9867	3.50E-03	5.077E+02	1.78E+00		Ce-143	4.33E-05	0.9867	4.27E-05	4.596E+01	1.96E-03
41	Br-85	3.75E-04	0.9867	3.70E-04	3.137E+01	1.16E-02		Ce-144	4.45E-05	0.9867	4.39E-05	0.000E+00	0.00E+00
42	Rb-88	2.62E-01	0.9867	2.59E-01	1.870E+02	4.83E+01		Pr-143	5.46E-05	0.9867	5.39E-05	4.637E-06	2.50E-10
43	Rb-89	1.49E-02	0.9867	1.47E-02	7.277E+02	1.07E+01		Pr-144	4.48E-05	0.9867	4.42E-05	1.049E+01	4.64E-04
44	Rb-90	1.16E-03	0.9867	1.14E-03	4.161E+02	4.76E-01		Np-239	6.60E-03	0.9867	6.51E-03	0.000E+00	0.00E+00
45	Sr-89	3.31E-04	0.9867	3.27E-04	6.843E-02	2.23E-05		Cs-138	9.76E-02	0.9867	9.63E-02	6.765E+02	6.51E+01
46	Sr-91	1.37E-04	0.9867	1.35E-04	3.306E+02	4.47E-02		Te-127m	3.20E-04	0.9867	3.16E-04	3.758E-02	1.19E-05
47		4.87E+01		4.81E+01		5.68E+02			1.69E+00		1.67E+00		8.14E+02
48									5.04E+01	- TOTALS -	4.97E+01	- TOTALS -	1.38E+03
49									uCi/g RCS		uCi/cc @ 130 degF		cpm

50 *Density correction = 0.9867 g/cc (based on letdown temperature of 130 degrees F)

52 Col B & I values from 12241-UR(B)-484 Table 9.2 — Col D = Col B * Col C ; Col K = Col I * Col J

53 Col C & J = 61.6 lbm/ft³ @130 degF / 62.43 lbm/ft³ standard = 0.9867 — Col E & L values from ERS-SFL-86-026 r3

54 Col F = Col D * Col E ; Col M = Col K * Col L

57 CF11 calculation: CF11 = at-monitor activity at T.S. limit (uCi/cc) / monitor count rate with RCS at T.S. limit (cpm)

58 **CF11 = 4.97E+01 / 1.38E+03 = 3.60E-02 uCi/cc-cpm**

59 uCi/cc @ 130 degF — cpm

61 cpm — uCi/cc-cpm — uCi/cc

62 **Monitor indication @0.35 uCi/g DE I-131 = 1.38E+03 x 3.60E-02 = 4.97E+01**

63 **High alarm trip setpoint (indication with 21% instrument error included) = 4.11E+01**

64 **Alert alarm trip setpoint (75% of the High setpoint with 21% instrument error included) = 3.08E+01**

65 **Monitor indication @21 uCi/g DE I-131 (4.66E+01 * (21 / 0.35) = 2.98E+03**

67 Note: Higher precision than shown is carried through the calculation.

Note: The isotopes used are consistent with the original calculation and not all of the isotopes in UR(B)-484 are included.

8. ERS-ATL-93-021, “Process Alarm Setpoints For Liquid Effluent Monitors,” Revision 3

FORM 1/2-ADM-1611.F28, Rev. 2 RTL# A9.621A

Beaver Valley Power Station

Radiation Protection Technical Position/Evaluation/Calculation

Subject	No.	PAGE 1 OF
Process Alarm Setpoints For Liquid Effluent Monitors	**ERS-ATL-93-021**	34

Reference

HPP: 1-HPP-4.02.001, 002 & 013, 2-HPP-4.02.018 & 021, **EPP:** EPP-I-1a Table 7-1, **ITS:** 6.5.2, **CR:** 02-06174-002, 06-06059-04, 08-50435 & 08-50765, **DCP:** 268, **ENV:** 1/2-ENV-05.04

Category

☐ Technical Position ☐ Technical Evaluation ■ Calculation

Unit 1 ■ Unit 2 ■

Purpose

The purpose of this calculation package is to provide consistent alarm setpoint methodology that is traceable to the ODCM bases for the following liquid effluent monitors:

1. For RMS Victoreen Monitors RM-1RW-100, RM-1RW-101, RM-1DA-100, RM-1LW-104 and RM-1LW-116.
2. For DRMS GA/Sorrento Monitors 2SGC-RQ100, 2SWS-RQ101 and 2SWS-RQ102.

☐ **ORIGINAL ISSUE**

☒ **REVISION # 3**

Revision description:

SAP Order 200197646-0710: Determine effect on the current alarm setpoints of Unit 1 Aux Feedwater Area Drain Radiation Monitor [RM-1DA-100], as previously provided in Calculation No. 8700-UR(B)-223, Rev 0 (Impact of Atmospheric Containment Conversion, Power Uprate, and Alternate Source Terms on the Alarm setpoints for the RadiationMonitors at BVPS-1) due to vendor upgrade FROM the Model 843-32 gamma scintillation detector TO the Model 843-32R replacement gamma scintillation detector. (See Attachment 6)

by	checker/reviewer	independent review (calculation only)
AT Lonnett 12-19-08 Anthont T Lonnett date	John TLobda 12-23-08 date	NA; No Change In Methodogy date

Checklist

■ Purpose ■ Results
■ Methodology ■ References
■ Input Data

Attachments

☐ Data Sheets
☐ Illustrations
■ Printouts
☐ Code Listings

■ Transmittal to BVRC
■ Original RP ERF FILE
☐ MGR, Radiation Protection
☐ Supt, Rad Ops
☐ Supv, RP Services
■ Supv, Rad Waste/Effluents
■ Author: AT Lonnett
■ EP: Manager, EP
☐
☐

RTL #A9.621A

Beaver Valley Power Station Radiation Protection Section	ERS-ATL-93-021 Revision 3	Page 2

Radiation Protection Technical Evaluation/Calculation	REVISION	

Subject

Process Alarm Setpoints For Liquid Effluent Monitors

OF ____________

Reference
1/2-HPP-3.06.005, 1/2-HPP-4.02.001, 002, 013, 018 and 021; T/S 6.8.6a; DCP 268; CR 02-06174-002, CR06-06059-04

Category

☐ Technical Position ☐ Technical ■ Calculation

Unit 1 ■ Unit 2 ■

Purpose
The purpose of this calculation package is to provide consistent alarm setpoint methodology that is traceable to the ODCM bases for the following liquid monitors:

1. For RMS Victoreen Monitors RM-1RW-100, RM-1RW-101, RM-1DA-100, RM-1LW-104 and RM-1LW-116.
2. For DRMS GA/Sorrento Monitors 2SGC-RQ100, 2SWS-RQ101 and 2SWS-RQ102.

Rev.	Signatures	Description
	by ____ *date* *checker/reviewer* ____ *date* *indep review (calculation only)* ____ *date*	
	By ____ *date* *checker/reviewer* ____ *date* *Indep review (calculation only)* ____ *date*	
2	*By* ***Anthony T Lonnett, 07/21/06*** *Checker/reviewer* ***Michael D Banko, 07/28/06*** *Indep review (calculation only)* ***NA, No Change in Methodology***	**CR05-06059-04:** Determine revised alarm setpoints for Unit 1 liquid radiation monitors due to vendor upgrade of Model 843-30 gamma scintillation detector with the Model 843-30R replacement detector.
1	*By* ***Anthony T Lonnett, 08/21/02*** *Checker/reviewer* ***Robert A Moore, 08/28/02*** *Indep review (calculation only)* ***NA, No Change in Methodology***	1. Add Zn-65 to ODCM Liquid Effluent Source Term per (CR02-06174-002) 2. Revise Unit 1 Source Term per S&W Calc UR(B)-160-3 3. Provide documentation that the EPP-EAL's are based on 2 x ODCM Limit for a UE and 200 x ODCM limit for an Alert
0	*By* ***Anthony T Lonnett, 07/12/93*** *checker/reviewer* ***DK Yourd, 09/08/93*** *indep review (calculation only)* ***SF Lavie for RSC, 10/06/93***	Checklist: ■ Purpose ■ Assumptions ■ Methodology ■ Input Data ■ Results ■ References Attachments: ☐ Data Sheets ■ Illustrations ■ Printouts ☐ Code Listings

■ BV RECORDS CENTER	■ Supv, Rad Ops-1	■ Author: AT Lonnett
■ Calculation File	☐ Supv, Rad Ops-2	■ EP: RL Harris
☐ MGR, Health Physics	☐ Supv, Effl & Rad Waste	☐ ____
■ Supv, Rad Eng & Health	■ Training Section	☐ ____

DISCUSSION

The objective of this calculation package is to provide consistent alarm setpoint methodology that is traceable to ODCM setpoint methodology for all liquid effluent pathway radiation monitors at Unit 1 and Unit 2.

Original Alarm Setpoint Bases

The original alarm setpoint calculations for Unit 1 and 2 effluent monitors were based on the following:

1. For monitors RM-1RW-100 (Component Cooling/Recirculation Spray Heat Exchanger River Water Monitor) and RM-1RW-101 (Component Cooling Heat Exchanger River Water Monitor) the setpoints were documented in Reference 1. The setpoints were based on 10 CFR 20 Appendix B to 20.1-20.601, Table II, Col. 2 MPCs (i.e., HSP = 1 MPC and HHSP = 10 MPC). Since operator actions (e.g., grab sampling and valving out the faulty heat exchanger) are the same for HSP or HHSP alarms, then 10 CFR 20 MPCs would be maintained.

2. For monitor RM-1DA-100 (Aux. Feed Pump Bay Drain Monitor), the setpoints were documented in Reference 2, and were based on MPCs (i.e., HSP = 0.25 MPC and HHSP = 8.3 MPC). Since Automatic Actions (e.g., termination of discharge) occur on a HSP alarm, then 10 CFR 20 MPCs would be maintained.

3. For monitors RM-1LW-104 (Liquid Waste Effluent Monitor) and RM-1LW-116 (Liquid Waste Contaminated Drain Monitor), the setpoints were documented in the ODCM, and were based on MPCs (i.e., HHSP = 0.8 MPC). Since Automatic Actions (e.g., termination of discharge) occur on a HHSP Alarm, then 10 CFR 20 MPCs would be maintained.

4. For monitor 2SGC-RQ100 (Liquid Waste Effluent Monitor), the setpoints were documented in the ODCM and were based on MPCs (i.e., HSP = 0.8 MPC). Since Automatic Actions (e.g., termination of discharge) occur on a HSP alarm, then 10 CFR 20 MPCs would be maintained.

5. For monitors 2SWS-RQ101 and 2SWS-RQ102 (Service Water Monitors), the setpoints were documented in Reference 21, and were based on two times the background in the process stream. Since this type of methodology would yield a very low setpoint, then it could be assumed that 10 CFR 20 MPCs would be maintained in the event of monitor alarms. However, this methodology is so conservative, it could result in nuisance alarms.

Technical Specification Requirements (Reference 6)

Integrated Technical Specification 5.5.2.a & b includes administrative requirements alarm/trip setpoints that ensure maintenance of 10 x 10CFR20 EC's for liquid effluents. BVPS implements this TS requirement via the alarm setpoints of liquid effluent radiation monitors RM-1RW-100, RM-1RW-101, RM-1DA-100, RM-1LW-104, RM-1LW-116, and 2SGC-RQ100, 2SWS-RQ101, and 2SWS-RQ102.

BVPS-1 UFSAR Requirements (Reference 7)

1. Section 11.3.3.1 indicates that effluent flow to the environment will be automatically terminated or processed in the event of a HHSP alarm. This statement is generic, it is not intended as a specific requirement for all process monitors.

2. Section 11.3.3.3.10 does not contain any requirements for alarm setpoints of RM-1RW-101. However, it does indicate that the monitor is used to detect leakage from the RCS or an auxiliary system into the component cooling water system.

3. Section 11.3.3.3.11 indicates that a HHSP alarm on RM-1LW-116 will automatically terminate the discharge from the contaminated drain system.

4. Section 11.3.3.3.12 indicates that a HHSP alarm on RM-1LW-104 will automatically terminate the discharge from the liquid waste system.

5. Section 11.3.3.3.17 does not contain any requirement for alarm setpoints of RM-1RW-100. However, it does indicate that the monitor is used to detect a leak from the primary plant component cooling water heat exchangers or the recirculation spray heat exchangers.

6. Section 11.3.3.3.26 indicates that a HHSP alarm on RM-1DA-100 will automatically direct the auxiliary feedwater area drain tank discharge from the yard oil separator to the safeguards tunnel sump. <u>NOTE:</u> Even though the BVPS-1 UFSAR indicates that these automatic actions occur on a HHSP alarm, DCP-268 required these actions on a HSP alarm, and it is installed per the DCP-268 requirement (Reference 2).

<u>BVPS-2 UFSAR Requirements</u> (Reference 8)

1. Section 11.5.2.4.3 indicates that a HSP alarm on 2SGC-RQ100 will automatically terminate a discharge from the liquid waste system.

2. Section 11.5.2.5.7 indicates that a HSP alarm on 2SWS-RQ102 is indicative of a leaky component cooling heat exchanger.

3. Section 11.5.2.5.8 does not contain any requirements for alarm setpoint of 2SWS-RQ101. However, it does indicate that an activity measurement is indicative of a leaky component cooling heat exchanger. This monitor acts as a redundant channel to 2SWS-RQ102.

<u>BVPS-1 USNRC SER Requirements</u> (Reference 9)

Section 11.6 indicates that the process radiation monitoring system will detect, indicate, annunciate, and/or record the levels or fields of activity to verify compliance with 10 CFR Part 20 and keep radiation levels as low as practicable. This statement is generic, it is not intended as a specific requirement for all process monitors.

<u>BVPS-2 USNRC SER Requirements</u> (Reference 10)

Section 11.5.2 indicates that provisions to provide automatic termination of effluent releases and ensure control over discharges is in accordance with GDC 63.

<u>Other Regulatory Commitments</u>

None.

Offsite Dose Calculation Manual (ODCM) Requirements (Reference 3)

ODCM procedure 1/2-ODC-2.01 requires alarm setpoints that ensure maintenance of 10 x 10CFR20 ECs for liquid effluent monitors, RM-1LW-104, RM-1LW-116, RM-1RW-100, RM-1RW-101, RM-1DA-100, 2SGC-RQ100, 2SWS-RQ101, and 2SWS-RQ102.

Instrument Error Considerations

The original Unit 1 alarm setpoint calculations did not consider the effect of instrument and process errors on the alarm setpoints. Unit 2 alarm setpoints did assess this effect for most monitors, and the Unit 2 UFSAR does contain a commitment to Regulatory Guide 1.105 (Reference 11). The Radiation Safety Committee discussed this issue in meeting BV-RSC-25-87 (Reference 12). From these discussions, a position with regard to the applicability of RG 1.105 to the radiation monitors was developed and documented in ERS-SFL-87-036 (Reference 13). From this position, it is inferred that, as a licensing item, RG 1.105 does not apply to the liquid effluent monitors at Unit 1 and Unit 2.

BASES

The alarm setpoints will be calculated using current ODCM methodology for liquid effluent monitor setpoints.

INPUT DATA/ASSUMPTIONS

	References
1. Ai = Particulate Activity from the release path (Ci/yr)	[3, 4, 14]
2. f = Maximum Acceptable Discharge Flowrate (gpm)	[3, 18, 19, 25]
3. F = Dilution Water Flowrate (gpm)	[3, 25, 26]
4. Ei = Monitor Sensitivity (cpm/uCi/cc)	[15, 16, 17, 23, 24]

METHODOLOGY

An EXCEL spreadsheet was generated to perform the alarm setpoint calculations.

See Attachment 2 for historical (Old Method) alarm setpoints based on 1 x old 10 CFR 20 MPC's.

See Attachment 3 for current (New Method) alarm setpoints based on 10 x new 10 CFR 20 EC's.

1. Si values were calculated using ODCM 1/2-ODC-2.01 equation [1.1(1)-2) and 1.1(2)-2]:

$$S_i = \frac{A_i}{\sum_i A_i}$$

where: S_i = the fraction of total radioactivity

A_i = the appropriate individual nuclide source term values from ODCM 1/2-ODC-2.01 Table 1.1-1a and 1.1-1b or Calculation Package No. ERS-SFL-92-037.

NOTE 1: ODCM A_i values were derived by Stone and Webster and shown in Table 13 of Reference 4.

NOTE 2: Zn-65 was not projected as a source term radionuclide when the ODCM was originally developed. However, SINCE zinc may be added to the RCS, THEN Zn-65 needed to be added to the ODCM Liquid Effluent Source Term. See Attachment 4 for deviation of the Zn-65 activity that was added to ODCM 1/2-ODC-2.01 Tables 1.1-1a and 1.1-1b (Reference 22).

2. C_t value was calculated using ODCM 1/2-ODC-2.01 equation [1.1(1)-3 and 1.1(2)-3]:

$$C_t = \frac{F}{f \dfrac{\sum_i S_i}{OEC_i}}$$

where: = F = Dilution water flow rate (gpm)

= 22,800 gpm for RM-1LW-104, RM-1LW-116, and 2SGC-RQ100 (15,000 gpm + 7,800 gpm)

= 149,800 gpm for RM-1RW-100 and RM-1RW-101 (127,000 gpm + 15,000 gpm + 7,800 gpm)

= 86.9 gpm for RM-1DA-100: Assumes that the toal flow from Outfall 003 is the sum of 23.8 gpm (0.0343 MGD) from Internal Outfall 103 + 38.9 gpm (0.056 MGD) from Internal Outfall 303 + 24.3 gpm (35,000 gpd) as the approximate Make-up Rate for the Secondary System (References 25 & 26)

= 8400 gpm for 2SWS-RQ101 and 2SWS-RQ102

f = Maximum acceptable discharge flow rate prior to dilution (gpm)

= 35 gpm for RM-1LW-104

= 15 gpm for RM-1LW-116

= 80 gpm for 2SGC-RQ100

= 18,000 gpm for RM-1RW-100

= 9,000 gpm for RM-1RW-101

= 33.3 gpm for RM-1DA-100: Assumes ~86% of the 38.9 gpm (0.056 MGD) from Internal Outfall 303 is from the Auxliary Feed Pump Drain System

= 7220 gpm for 2SWS-RQ101 and 2SWS-RQ102

S_i = Previously described

3. C_i values were calculated using ODCM 1/2-ODC-2.01 equation [1.1(1)-4 and 1.1(2)-4]:

$C_i = S_i \ C_t$

where: C_i = max acceptable concentration for each radionuclide (uCi/ml)

S_i = previously described

C_t = previously described

4. The monitor count rate (CR) was calculated using ODCM 1/2-ODC-2.01 equation [1.1(1)-5 and 1.1(2)-5]:

$$CR = \sum_i C_i \; E_i$$

<u>where</u>: CR = monitor count rate attributed from each radionuclide in ncpm

Ci = previously described

Ei = detection efficiency for the appropriate monitor (cpm/uCi/cc) References 15, 16, 17, 23 and 24

5. <u>FOR UNIT 2 ONLY</u>: The Unit 2 monitor display value (DV) was calculated using ODCM 1/2-ODC-2.01 equation [1.1(2)-5]:

$$DV = CF11 \sum_i C_i \; E_i$$

<u>where</u>: $CF11 = \sum_i C_i \; / \sum_i C_i E_i$ = Conversion factor (uCi/ml/cpm) is an average determined for the source term mix. Original derivations of the CF11 are shown in Reference 20 and 21.

E_i = Previously described

C_i = Previously described

6. The monitor alarm process setpoints were calculated as follows:

Unit 1: HHSP = 1.00 CR <u>and</u> HSP = 0.70 HHSP

Unit 2: HSP = 1.00 DV <u>and</u> ASP = 0.70 HSP

<u>where</u>: the process upper alarms (HHSP and HSP) and the process lower alarms (HSP and ASP) are the monitor alarmsetpoints above background for the process stream (net cpm or net uCi/cc)

CR = previously described

1.00 and 0.70 = Fractions of total radioactivity concentration that may be released via the monitored pathway to ensure that the 10 CFR 20 MPCs, or 10 x 10CFR20 ECs are maintained.

The Emergency Preparedness Plan - Emergency Action Level (EPP-EAL) values were calculated as follows:

Unit 1 UE = 2 x ODCM Limit = 2 x HHSP

Unit 1 Alert = 200 x ODCM Limit = 200 x HHSP

Unit 2 UE = 2 x ODCM Limit = 2 x HSP

Unit 2 Alert = 200 x ODCM Limit = 200 x HSP

RESULTS

See Attachment 1 for the alarm setpoints (both Old Method and New Method) of liquid effluent monitors at Unit 1 and Unit 2. The alarm setpoints are normally adjusted to ≤ the values listed in the New Method.

REFERENCES

1. SWEC, Radiation Monitor Setpoints, DLS-12168; October 21, 1975
2. FENOC, DCP 268 - Radiation Alarm Setpoints, letter ND1ROC:635; April 16, 1982
3. FENOC, Offsite Dose Calculation Manual Procedure 1/2-ODC-2.01, ODCM: Liquid Effluents
4. SWEC, UR(B)-160, BVPS Liquid Radwaste Releases and Concentrations - Expected and Design Cases: Per Unit and Site, Revision 3; 1983
5. FENOC, Offsite Dose Calculation Manual Procedure 1/2-ODC-3.03, Control for RETS and REMP Programs, Table 3.3-12 of ODCM Control 3.3.3.9
6. FENOC, Units 1 and 2 Integrated Technical Specification 5.5.2.a and 5.5.2.b
7. FENOC, Updated Final Safety Analysis Report Unit 1, Section 11.3
8. FENOC, Updated Final Safety Analysis Report Unit 2, Section 11.5
9. USNRC, Safety Evaluation Report Related To The Operation Of The Beaver Valley Power Station Unit 1, (Through Supplement 3)
10. USNRC, Safety Evaluation Report Related To The Operation Of The Beaver Valley Power Station Unit 2, (Through Supplement 6)
11. USNRC, Instrument Setpoints, Regulatory Guide 1.105; 1976
12. FENOC, Minutes of Radiation Safety Committee Meeting 25-87, BV-RSC-25-87; 1987
13. FENOC, Applicability Of RG 1.105 To BVPS Radiation Monitors, ERS-SFL-87-036, Revision 0; 1987
14. FENOC, Alarm Trip Setpoints For RM-1RW-100A, B, C, D, ERS-SFL-92-037, Revision 0; 1993
15. FENOC, Isotopic Efficiencies For Unit 1 Liquid Process Monitors, ERS-SFL-92-039, Revision 0; 1992

16. FENOC, Unit 2 DRMS Isotopic Efficiencies, ERS-SFL-86-026, Revision 6; 1991

17. FENOC, Isotopic Efficiencies (2SGC-RQ100), ERS-JWW-87-015, Revision 0; 1987

    NOTE: Isotopic Efficiencies for 2SGC-RQ100 are superceded by ERS-SFL-86-026

18. FENOC, Unit 2 Liquid Release Rates, Memorandum, September 20, 1989, A. T. Lonnett

19. FENOC, Discharge Rate (RM-1LW-116), Memorandum, November 1, 1989, A. T. Lonnett

20. FENOC, Conversion Factor For 2SGC-RQ100, ERS-WFW-87-021, Revision 0; 1987

    NOTE: CF11 Conversion Factor for 2SGC-RQ100 is superceded by ERS-ATL-93-021

21. SWEC, Safety Limits For Liquid Process Monitors 2CCP-RQ100, 2SWS-RQ101, and 2SWS-RQ102, UR(B)-417, Revision 0; 1986

    NOTE: CF11 Conversion Factors for 2SWS-RQ101 and 102 are superceded by ERS-ATL-93-026

22. Westinghouse Letter dated August 1, 2002, Zinc Injection Project: Operational Value of Zn-65 for Beaver Valley Zinc Injection

23. FLUKE Bimedical Letter dated April 19, 2006, Revised Model 843-30R Efficiencies

24. Condition Report No. CR05-06059-04: Document liquid effluent monitor alarm setpoint bases for ODC, HPP, ENV and EPP-EAL implementing procedures.

25. FENOC, 1/2-ADM-0604, Preparation of the Discharge Monitoring Report

26. FENOC, Form 1/2-ENV-05.04.F04, RWDA-L Special Release Quantification

27. SAP Order 200197646-0710, Determine revised alarm setpoints for [RM-1DA-100] due to upgrade FROM the model 843-32 detector TO the Model 843-32-R detector. This upgrade was necessary due to repeat failures of Model 843-32 detectors as documented in CR08-50435, CR08-50765 & CR08-50899).

ATTACHMENTS

1. (see pages 10 – 11) Summary - Process Alarm Setpoints
2. (see pages 12 – 19) Historical Alarm Setpoints Based on 1 x Old 10 CFR 20 MPC's
3. (see pages 20 – 27) Current Alarm Setpoints Based on 10 x New 10 CFR 20 EC's
4. (see page 28) Determination of Zn-65 Ci/yr value for ODCM
5. (see pages 29 – 32) Fluke Biomedical Letter dated April 19, 2006, Revised Model 843-30R Efficiencies
6. (see page 33 – 34) Evaluation of the effect on [RM-1DA-100] Alarm Setpoints due to Detector Upgrade.

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Summary - Process Alarm Setpoints
For Liquid Effluent Monitors
(For Information Only - *DO NOT USE*)

Old / Previous ODCM Method -
OLD METHOD - Based on: 1 x Old 10 CFR 20 MPC's

RM-1RW-100 Alarm Setpoints

HHSP = CR =	1.49E+03	cpm
HSP = CR x 0.7 =	1.04E+03	cpm
UE = 2 x HHSP =	2.97E+03	cpm
Alert = 200 x HHSP =	2.97E+05	cpm

RM-1RW-101 Alarm Setpoints

HHSP = CR =	1.14E+03	cpm
HSP = CR x 0.7 =	7.97E+02	cpm
UE = 2 x HHSP =	2.28E+03	cpm
Alert = 200 x HHSP =	2.28E+05	cpm

RM-1DA-100 Alarm Setpoints (Model 843-32R Detector)

HHSP = CR =	2.98E+02	cpm
HSP = CR x 0.7 =	2.09E+02	cpm
UE = 2 x HHSP =	5.97E+02	cpm
Alert = 200 x HHSP =	5.97E+04	cpm

RM-1LW-116 Alarm Setpoints

HHSP = CR =	1.04E+05	cpm
HSP = CR x 0.7 =	7.28E+04	cpm
UE = 2 x HHSP =	2.08E+05	cpm
Alert = 200 x HHSP =	2.08E+07	cpm

RM-1LW-104 Alarm Setpoints

HHSP = CR =	4.46E+04	cpm
HSP = CR x 0.7 =	3.12E+04	cpm
UE = 2 x HHSP =	8.92E+04	cpm
Alert = 200 x HHSP =	8.92E+06	cpm

2SGC-RQ100 Alarm Setpoints

HSP =	1.41E-04	uCi/ml
ASP =	9.84E-05	uCi/ml
CF11 =	5.61E-09	uCi/ml/cpm
UE = 2 x HSP =	2.81E-04	uCi/ml
Alert = 200 x HSP =	2.81E-02	uCi/ml

2SWS-RQ101 & Alarm Setpoints
2SWS-RQ102

HSP =	1.32E-06	uCi/ml
ASP =	9.23E-07	uCi/ml
CF11 =	5.71E-09	uCi/ml/cpm
UE = 2 x HSP =	2.64E-06	uCi/ml
Alert = 200 x HSP =	2.64E-04	uCi/ml

Summary - Process Alarm Setpoints
For Liquid Effluent Monitors
(For ODC 1/2-ODC-2.01 & Related HPP & ENV Procedures)

New / Current ODCM Method -
NEW METHOD - Based on: 10 x New 10 CFR 20 EC's

RM-1RW-100 Alarm Setpoints

HHSP = CR =	3.67E+04	cpm
HSP = CR x 0.7 =	2.57E+04	cpm
UE = 2 x HHSP =	7.33E+04	cpm
Alert = 200 x HHSP =	7.33E+06	cpm

NOTE: The net alarm setpoints for: All Monitors SHALL NOT be set at > than these values. Therefore, actual net setpoins SHALL be set at < or = to these

RM-1RW-101 Alarm Setpoints

HHSP = CR =	1.04E+04	cpm
HSP = CR x 0.7 =	7.29E+03	cpm
UE = 2 x HHSP =	2.08E+04	cpm
Alert = 200 x HHSP =	2.08E+06	cpm

RM-1-DA-100 Alarm Setpoints (843-32 and 843-32R Detector)

Re-Evaluated HHSP (843-32R) = CR =	1.22E+04	cpm, or 1.5% increase from Current HHSP
Re-Evaluated HHSP (843-32) =	1.05E+04	cpm, or 12.8% decrease from Current HHSP
Current HHSP (843-32) =	1.20E+04	cpm
Re-Evaluated HSP (843-32R) = CR x 0.7 =	8.52E+03	cpm, or 1.1% increase from Current HSP
Re-Evaluated HSP (843-32) =	7.33E+03	cpm, or 13.1% decrease from Current HSP
Current HSP (843-32) =	8.43E+03	cpm
Re-Evaluated UE-EAL (843-32R) = 2 x HHSP =	2.44E+04	cpm, or NO change from Current UE-EAL
Re-Evaluated UE-EAL (843-32) =	2.09E+04	cpm, or 14.2% decrease from Current UE-EAL
Current UE-EAL (843-32) =	2.44E+04	cpm
Re-Evaluated Alert-EAL (843-32R) = 200 x HHSP =	2.44E+06	cpm, or NO change from Current Alert-EAL
Re-Evaluated Alert-EAL (843-32) =	2.09E+06	cpm, or 14.2% decrease from Current Alert-EAL
Current Alert-EAL =	2.44E+06	cpm

NOTE 1: See evaluation provided in Attachment 6 that indicates the current alarm setpoints for [RM-1DA-100], as previously provided in Calculation No. 8700-UR(B)-223, Rev 0, are still valid and do not require revision. Therefore, the alarm setpoints and the EPP-EAL values SHALL remain at the current values.

NOTE 2: SINCE the calculated Alert EAL values exceed the range of the instrument, THEN the actual Alert EAL values are "Not Applicable"

RM-1LW-116 Alarm Setpoints

HHSP = CR =	9.50E+05	cpm
HSP = CR x 0.7 =	6.65E+05	cpm
UE = 2 x HHSP =	1.90E+06	cpm
Alert = 200 x HHSP =	1.90E+08	cpm

RM-1LW-104 Alarm Setpoints

HHSP = CR =	4.07E+05	cpm
HSP = CR x 0.7 =	2.85E+05	cpm
UE = 2 x HHSP =	8.15E+05	cpm
Alert = 200 x HHSP =	8.15E+07	cpm

2SGC-RQ100 Alarm Setpoints

HSP = 1.14E-03	uCi/ml
ASP = 7.99E-04	uCi/ml
CF11 = 5.61E-09	uCi/ml/cpm
UE = 2 x HSP = 2.28E-03	uCi/ml
Alert = 200 x HSP = 2.28E-01	uCi/ml

2SWS-RQ101 & Alarm Setpoints
2SWS-RQ102

HSP = 4.30E-05	uCi/ml
ASP = 3.01E-05	uCi/ml
CF11 = 5.71E-09.	uCi/ml/cpm
UE = 2 x HSP = 8.59E-05	uCi/ml
Alert = 200 x HSP = 8.59E-03	uCi/ml

RM-1RN-100 Alarm Setpoints

OLD METHOD - Based on: 1 x Old 10 CFR 20 MPC's

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Nuclide	Ai Annual Release (Ci)	Si	Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	1 x Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	Si/MPC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	0.00E+00	0.00E+00	2E-03	2E-03	0.00E+00	0.00E+00	1.24E+07	0
Co-58	4.86E+00	1.19E-03	9E-05	9E-05	1.32E+01	1.45E-08	1.06E+08	2
Co-60	1.46E-01	3.57E-05	3E-05	3E-05	1.19E+00	4.37E-10	1.94E+08	0
Rb-88	6.21E+02	1.52E-01	3E-06	3E-06	5.06E+04	1.86E-06	3.73E+07	69
Sr-89	7.83E-01	1.91E-04	3E-06	3E-06	6.38E+01	2.34E-09	9.84E+03	0
Sr-90	1.86E-02	4.55E-06	3E-07	3E-07	1.52E+01	5.57E-11	0.00E+00	0
Y-90	2.27E-02	5.55E-06	2E-05	2E-05	2.77E-01	6.79E-11	0.00E+00	0
Sr-91	3.78E-01	9.24E-05	5E-05	5E-05	1.85E+00	1.13E-09	8.13E+07	0
Y-91	1.27E-01	3.10E-05	3E-05	3E-05	1.03E+00	3.80E-10	2.53E+05	0
Zr-95	1.32E-01	3.23E-05	6E-05	6E-05	5.38E-01	3.95E-10	1.06E+08	0
Nb-95	1.32E-01	3.23E-05	1E-04	1E-04	3.23E-01	3.95E-10	1.06E+08	0
Zr-97	7.56E-02	1.85E-05	2E-05	2E-05	9.24E-01	2.26E-10	1.17E+08	0
Mo-99	6.21E+02	1.52E-01	4E-05	4E-05	3.79E+03	1.86E-06	1.41E+08	262
Tc-99m	3.51E+02	8.58E-02	3E-03	3E-03	2.86E+01	1.05E-06	1.11E+08	117
Ru-103	6.48E-02	1.58E-05	8E-05	8E-05	1.98E-01	1.94E-10	1.13E+08	0
Ru-105	5.67E-03	1.39E-06	1E-04	1E-04	1.39E-02	1.70E-11	7.84E+07	0
Ru-106	4.32E-03	1.06E-06	1E-05	1E-05	1.06E-01	1.29E-11	0.00E+00	0
Rh-105	1.62E-02	3.96E-06	1E-04	1E-04	3.96E-02	4.85E-11	3.07E+07	0
Te-127m	3.51E-01	8.58E-05	5E-05	5E-05	1.72E+00	1.05E-09	1.62E+07	0
Te-127	1.92E-01	4.69E-05	2E-04	2E-04	2.35E-01	5.75E-10	1.48E+06	0
Sb-127	2.67E-03	6.53E-07	3E-06	3E-06	2.18E-01	7.99E-12	1.25E+08	0
Sb-129	6.21E-03	1.52E-06	3E-06	3E-06	5.06E-01	1.86E-11	1.47E+08	0
Te-129m	7.29E+00	1.78E-03	2E-05	2E-05	8.91E+01	2.18E-08	1.11E+05	0
Te-129	4.05E+00	9.90E-04	8E-04	8E-04	1.24E+00	1.21E-08	1.69E+07	0
Te-131m	4.32E+00	1.06E-03	4E-05	4E-05	2.64E+01	1.29E-08	1.15E+06	0
I-131	4.86E+02	1.19E-01	3E-07	3E-07	3.96E+05	1.45E-06	1.18E+08	172
Te-132	5.13E+01	1.25E-02	2E-05	2E-05	6.27E+02	1.54E-07	1.21E+08	19
I-132	1.70E+02	4.16E-02	8E-06	8E-06	5.19E+03	5.09E-07	3.16E+08	161
I-133	7.83E+02	1.91E-01	1E-06	1E-06	1.91E+05	2.34E-06	1.16E+08	272
I-134	1.05E+02	2.57E-02	2E-05	2E-05	1.28E+03	3.14E-07	3.17E+08	100
I-135	4.05E+02	9.90E-02	4E-06	4E-06	2.47E+04	1.21E-06	1.47E+08	178
Cs-137	2.46E+02	6.01E-02	2E-05	2E-05	3.01E+03	7.36E-07	9.30E+07	68
Ba-137m	2.27E+02	5.55E-02	2E-05	2E-05	2.77E+03	6.79E-07	9.85E+07	67
Ba-140	8.10E-01	1.98E-04	2E-05	2E-05	9.90E+00	2.42E-09	4.78E+07	0
La-140	2.97E-01	7.26E-05	2E-05	2E-05	3.63E+00	8.89E-10	2.22E+08	0
Ce-141	1.30E-01	3.18E-05	9E-05	9E-05	3.53E-01	3.89E-10	6.20E+07	0
Ce-143	9.72E-02	2.38E-05	4E-05	4E-05	5.94E-01	2.91E-10	7.87E+07	0
Ce-144	6.75E-02	1.65E-05	1E-05	1E-05	1.65E+00	2.02E-10	1.36E+07	0
Pr-143	1.27E-01	3.10E-05	5E-05	5E-05	6.21E-01	3.80E-10	0.00E+00	0
Pr-144	6.75E-02	1.65E-05	0E+00	0E+00	-----	2.02E-10	2.32E+06	0
Nd-147	4.59E-02	1.12E-05	6E-05	6E-05	1.87E-01	1.37E-10	3.37E+07	0
H-3	0.00E+00	0.00E+00	3E-03	3E-03	0.00E+00	0.00E+00	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-07	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	4.09E+03	1.00E+00			6.80E+05	1.22E-05		1487
Total H-3	0.00E+00				0.00E+00	0.00E+00		0
Total W/O H-3	4.09E+03				6.80E+05	1.22E-05		1487

Ai: RCS Activity, From Calc Package No. ERS-SFL-92-037
Ei: (843-30 Data) From Calc Package No. ERS-SFL-92-039

F = 149800 gpm = Dilution Flowrate (127,000 gpm + 15,000 gpm + 7,800 gpm)
f = 18000 gpm = Discharge flowrate (9,000 gpm / RPRWP: Assumes 2 RPRWPs operating)
Ct = 1.22E-05 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)
Ci = Si x Ct

CR = Sum (CiEi) = 1.49E+03 cpm
HHSP = CR = 1.49E+03 cpm
HSP = CR x 0.7 = 1.04E+03 cpm

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Attachment 2

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RM-1RW-101 Alarm Setpoints

OLD METHOD - Based on: 1 x Old 10 CFR 20 MPC's

Nuclide	Ai Annual Release (Ci)	Si	Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	1 x Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	Si/MPC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	1.30E-03	2.36E-06	2E-03	2E-03	1.18E-03	2.82E-08	1.24E+07	0
Mn-54	3.10E-04	5.63E-07	1E-04	1E-04	5.63E-03	6.72E-09	1.05E+08	1
Fe-55	1.60E-03	2.91E-06	8E-04	8E-04	3.63E-03	3.47E-08	0.00E+00	0
Fe-59	8.30E-04	1.51E-06	5E-05	5E-05	3.02E-02	1.80E-08	1.04E+08	2
Co-58	1.40E-02	2.54E-05	9E-05	9E-05	2.83E-01	3.03E-07	1.06E+08	32
Co-60	2.00E-03	3.63E-06	3E-05	3E-05	1.21E-01	4.33E-08	1.94E+08	8
Zn-65	2.69E-02	4.88E-05	1E-04	1E-04	4.88E-01	5.82E-07	5.02E+07	29
Np-239	1.40E-04	2.54E-07	1E-04	1E-04	2.54E-03	3.03E-09	0.00E+00	0
Br-83	2.50E-05	4.54E-08	3E-06	3E-06	1.51E-02	5.42E-10	1.48E+06	0
Br-84	2.70E-06	4.91E-09	3E-06	3E-06	1.64E-03	5.85E-11	3.16E+08	0
Br-85	2.80E-08	5.09E-11	0E+00	0E+00	-----	6.07E-13	6.71E+06	0
Rb-86	7.50E-05	1.36E-07	2E-05	2E-05	6.81E-03	1.63E-09	0.00E+00	0
Rb-88	1.20E-04	2.18E-07	0E+00	0E+00	-----	2.60E-09	3.73E+07	0
Sr-89	2.90E-04	5.27E-07	3E-06	3E-06	1.76E-01	6.28E-09	9.84E+03	0
Sr-90	1.10E-05	2.00E-08	3E-07	3E-07	6.66E-02	2.38E-10	0.00E+00	0
Y-90	9.40E-06	1.71E-08	2E-05	2E-05	8.54E-04	2.04E-10	0.00E+00	0
Sr-91	1.30E-05	2.36E-08	5E-05	5E-05	4.72E-04	2.82E-10	8.13E+07	0
Y-91m	8.70E-06	1.58E-08	3E-03	3E-03	5.27E-06	1.89E-10	1.07E+08	0
Y-91	5.70E-05	1.04E-07	3E-05	3E-05	3.45E-03	1.24E-09	2.53E+05	0
Y-93	7.40E-07	1.34E-09	3E-05	3E-05	4.48E-05	1.60E-11	0.00E+00	0
Zr-95	5.10E-05	9.27E-08	6E-05	6E-05	1.54E-03	1.11E-09	1.06E+08	0
Nb-95	5.20E-05	9.45E-08	1E-04	1E-04	9.45E-04	1.13E-09	1.06E+08	0
Mo-99	1.10E-02	2.00E-05	4E-05	4E-05	5.00E-01	2.38E-07	1.41E+08	34
Tc-99m	1.10E-02	2.00E-05	3E-03	3E-03	6.66E-03	2.38E-07	1.11E+08	26
Ru-103	3.40E-05	6.18E-08	8E-05	8E-05	7.72E-04	7.37E-10	1.13E+08	0
Ru-106	1.00E-05	1.82E-08	1E-05	1E-05	1.82E-03	2.17E-10	0.00E+00	0
Rh-103m	3.40E-05	6.18E-08	1E-02	1E-02	6.18E-06	7.37E-10	0.00E+00	0
Rh-106	1.00E-05	1.82E-08	0E+00	0E+00	-----	2.17E-10	0.00E+00	0
Te-125m	2.50E-05	4.54E-08	1E-04	1E-04	4.54E-04	5.42E-10	2.40E+05	0
Te-127m	2.60E-04	4.72E-07	5E-05	5E-05	9.45E-03	5.63E-09	1.62E+07	0
Te-127	2.70E-04	4.91E-07	2E-04	2E-04	2.45E-03	5.85E-09	1.48E+06	0
Te-129m	1.10E-03	2.00E-06	2E-05	2E-05	9.99E-02	2.38E-08	1.11E+05	0
Te-129	6.70E-04	1.22E-06	8E-04	8E-04	1.52E-03	1.45E-08	1.69E+07	0
I-130	1.20E-04	2.18E-07	3E-06	3E-06	7.27E-02	2.60E-09	2.65E+08	1
Te-131m	1.60E-04	2.91E-07	4E-05	4E-05	7.27E-03	3.47E-09	1.15E+06	0
Te-131	3.00E-05	5.45E-08	0E+00	0E+00	-----	6.50E-10	1.11E+08	0
I-131	1.60E-01	2.91E-04	3E-07	3E-07	9.69E+02	3.47E-06	1.18E+08	409
Te-132	4.30E-03	7.81E-06	2E-05	2E-05	3.91E-01	9.32E-08	1.21E+08	11
I-132	4.90E-03	8.90E-06	8E-06	8E-06	1.11E+00	1.06E-07	3.16E+08	34
I-133	4.00E-02	7.27E-05	1E-06	1E-06	7.27E+01	8.67E-07	1.16E+08	101
I-134	8.00E-05	1.45E-07	2E-05	2E-05	7.27E-03	1.73E-09	3.17E+08	1
Cs-134	4.60E-02	8.36E-05	9E-06	9E-06	9.29E+00	9.97E-07	2.42E+08	241
I-135	4.30E-03	7.81E-06	4E-06	4E-06	1.95E+00	9.32E-08	1.47E+08	14
Cs-136	8.90E-03	1.62E-05	6E-05	6E-05	2.69E-01	1.93E-07	3.19E+08	62
Cs-137	3.30E-02	6.00E-05	2E-05	2E-05	3.00E+00	7.15E-07	9.30E+07	67
Ba-137m	3.10E-02	5.63E-05	2E-05	2E-05	2.82E+00	6.72E-07	9.85E+07	66
Ba-140	1.10E-04	2.00E-07	2E-05	2E-05	9.99E-03	2.38E-09	4.78E+07	0
La-140	1.10E-04	2.00E-07	2E-05	2E-05	9.99E-03	2.38E-09	2.22E+08	1
Ce-141	5.10E-05	9.27E-08	9E-05	9E-05	1.03E-03	1.11E-09	6.20E+07	0
Ce-143	2.80E-06	5.09E-09	4E-05	4E-05	1.27E-04	6.07E-11	7.87E+07	0
Ce-144	3.20E-05	5.81E-08	1E-05	1E-05	5.81E-03	6.93E-10	1.36E+07	0
Pr-143	2.70E-05	4.91E-08	5E-05	5E-05	9.81E-04	5.85E-10	0.00E+00	0
Pr-144	3.20E-05	5.81E-08	0E+00	0E+00	-----	6.93E-10	2.32E+06	0
H-3	5.50E+02	9.99E-01	3E-03	3E-03	3.33E+02	1.19E-02	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-07	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	5.50E+02	1.00E+00			1.40E+03	1.19E-02		1139
Total H-3	5.50E+02				3.33E+02	1.19E-02		0
Total W/O H-3	4.05E-01				1.06E+03	8.78E-06		1139

Ai: From ODCM 1/2-ODC-2.01 Table 1.1-1a (from Table 13 of S&W UR(B)-160)
Ei: (843-30 Data) From Calc Package No. ERS-SPL-92-039

F = 149800 gpm = Dilution Flowrate (127,000 gpm + 15,000 gpm + 7,800 gpm)
f = 9000 gpm = Disch. flowrate (9,000 gpm / RPRWP: With 2 RPRWPs, flow is split between CCW & RSP)
Ct = 1.19E-02 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)
Ci = Si x Ct

CR = Sum (CiEi) = 1.14E+03 cpm
HHSP = CR = 1.14E+03 cpm
HSP = CR x 0.7 = 7.97E+02 cpm

RM-1DA-100 Alarm Setpoints (Model 843-32 Detector) OLD METHOD - Based on: 1 x Old 10 CFR 20 MPC's

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Nuclide	Ai Annual Release (Ci)	Si	Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	1 x Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	Si/MPC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	0.00E+00	0.00E+00	2E-03	2E-03	0.00E+00	0.00E+00	1.18E+07	0
I-131	1.33E+02	2.60E-01	3E-07	3E-07	8.68E+05	5.14E-07	1.11E+08	57
I-132	4.77E+01	9.33E-02	8E-06	8E-06	1.17E+04	1.84E-07	2.66E+08	49
I-133	1.97E+02	3.86E-01	1E-06	1E-06	3.86E+05	7.61E-07	9.90E+07	75
I-134	2.33E+01	4.56E-02	2E-05	2E-05	2.28E+03	9.01E-08	2.70E+08	24
I-135	1.10E+02	2.15E-01	4E-06	4E-06	5.38E+04	4.25E-07	1.19E+08	51
H-3	0.00E+00	0.00E+00	3E-03	3E-03	0.00E+00	0.00E+00	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-07	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	5.11E+02	1.00E+00			1.32E+06	1.98E-06		256
Total H-3	0.00E+00				0.00E+00	0.00E+00		0
Total W/O H-3	5.11E+02				1.32E+06	1.98E-06		256

Ai: SGTR Source Term, From UR(B)-223
Ei: (843-30 Data) From Calc Package No. ERS-SFL-92-039
NOTE: Even though this monitor has a Model 843-32 detector, the vendor notes that the efficiencies are the same as those for the Model 843-30 detector.

F = 86.9 gpm = Dilution Flowrate (Total from Outfall 003), as follows:
23.8 gpm = 0.0342 MGD from Internal Outfall 103 (Reference: 1/2-ADM-0604)
38.9 gpm = 0.056 MGD from Internal Outfall 303 (Reference: 1/2-ADM-0604)
24.3 gpm = 35,000 gpd from Secondary Make-up (Reference: Form 1/2-ENV-05.04.F04)

f = 33.3 pgm = Discharge flowrate from Aux Feed Pump Drains to Internal Outfall 303 as follows:
33.3 gpm = Internal Outfall 303 Adjusted for Aux Feed Drain (i.e., 38.9 gpm x 86%)

Ct = 1.98E-06 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)
Ci = Si x Ct

CR = Sum (CiEi) = 2.56E+02 cpm
HHSP = CR = 2.56E+02 cpm
HSP = CR x 0.7 = 1.79E+02 cpm

RM-1DA-100 Alarm Setpoints (Model 843-32R Detector)

OLD METHOD - Based on: 1 x Old 10 CFR 20 MPC's

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Nuclide	Ai Annual Release (Ci)	Si	Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	1 x Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	Si/MPC (ml/uCi)	Ci (uCi/ml)	Bi Detection Efficiency (cpm/uCi/ml)	CiBi Count Rate (ncpm)
Cr-51	0.00E+00	0.00E+00	2E-03	2E-03	0.00E+00	0.00E+00	0.00E+00	0
I-131	1.33E+02	2.60E-01	3E-07	3E-07	8.68E+05	5.14E-07	1.18E+08	61
I-132	4.77E+01	9.33E-02	8E-06	8E-06	1.17E+04	1.84E-07	3.16E+08	58
I-133	1.97E+02	3.86E-01	1E-06	1E-06	3.86E+05	7.61E-07	1.16E+08	88
I-134	2.33E+01	4.56E-02	2E-05	2E-05	2.28E+03	9.01E-08	3.17E+08	29
I-135	1.10E+02	2.15E-01	4E-06	4E-06	5.38E+04	4.25E-07	1.47E+08	62
H-3	0.00E+00	0.00E+00	3E-03	3E-03	0.00E+00	0.00E+00	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-07	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	5.11E+02	1.00E+00			1.32E+06	1.98E-06		298
Total H-3	0.00E+00				0.00E+00	0.00E+00		0
Total W/O H-3	5.11E+02				1.32E+06	1.98E-06		298

Ai: SGTR Source Term, From UR(B)-223
Bi: (843-30R Data) From Calc Package No. ERS-SFL-92-039
NOTE: Even though this monitor has a Model 843-32R detector, the vendor notes that the efficiencies are the same as those for the Model 843-30R detector.

F = 86.9 gpm = Dilution Flowrate (Total from Outfall 003), as follows:
23.8 gpm = 0.0342 MGD from Internal Outfall 103 (Reference: 1/2-ADM-0604)
38.9 gpm = 0.056 MGD from Internal Outfall 303 (Reference: 1/2-ADM-0604)
24.3 gpm = 35,000 gpd from Secondary Make-up (Reference: Form 1/2-ENV-05.04.F04)

f = 33.3 pgm = Discharge flowrate from Aux Feed Pump Drains to Internal Outfall 303 as follows:
33.3 gpm = Internal Outfall 303 Adjusted for Aux Feed Drain (i.e., 38.9 gpm x 86%)

Ct = 1.98E-06 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)
Ci = Si x Ct

CR = Sum (CiEi) = 2.98E+02 cpm
HHSP = CR = 2.98E+02 cpm
HSP = CR x 0.7 = 2.09E+02 cpm

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RM-1LW-116 Alarm Setpoints

OLD METHOD - Based on: 1 x Old 10 CFR 20 MPC's

Nuclide	Ai Annual Release (Ci)	Si	Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	1 x Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	Si/MPC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	1.30E-03	2.36E-06	2E-03	2E-03	1.18E-03	2.57E-06	1.24E+07	32
Mn-54	3.10E-04	5.63E-07	1E-04	1E-04	5.63E-03	6.13E-07	1.05E+08	64
Fe-55	1.60E-03	2.91E-06	8E-04	8E-04	3.63E-03	3.17E-06	0.00E+00	0
Fe-59	8.30E-04	1.51E-06	5E-05	5E-05	3.02E-02	1.64E-06	1.04E+08	171
Co-58	1.40E-02	2.54E-05	9E-05	9E-05	2.83E-01	2.77E-05	1.06E+08	2937
Co-60	2.00E-03	3.63E-06	3E-05	3E-05	1.21E-01	3.96E-06	1.94E+08	768
Zn-65	2.69E-02	4.88E-05	1E-04	1E-04	4.88E-01	5.31E-05	5.02E+07	2668
Np-239	1.40E-04	2.54E-07	1E-04	1E-04	2.54E-03	2.77E-07	0.00E+00	0
Br-83	2.50E-05	4.54E-08	3E-06	3E-06	1.51E-02	4.95E-08	1.48E+06	0
Br-84	2.70E-06	4.91E-09	3E-06	3E-06	1.64E-03	5.34E-09	3.16E+08	2
Br-85	2.80E-08	5.09E-11	0E+00	0E+00	-----	5.54E-11	6.71E+06	0
Rb-86	7.50E-05	1.36E-07	2E-05	2E-05	6.81E-03	1.48E-07	0.00E+00	0
Rb-88	1.20E-04	2.18E-07	0E+00	0E+00	-----	2.37E-07	3.73E+07	9
Sr-89	2.90E-04	5.27E-07	3E-06	3E-06	1.76E-01	5.74E-07	9.84E+03	0
Sr-90	1.10E-05	2.00E-08	3E-07	3E-07	6.66E-02	2.18E-08	0.00E+00	0
Sr-91	9.40E-06	1.71E-08	5E-05	5E-05	3.42E-04	1.86E-08	0.00E+00	0
Y-90	1.30E-05	2.36E-08	2E-05	2E-05	1.18E-03	2.57E-08	8.13E+07	2
Y-91m	8.70E-06	1.58E-08	3E-03	3E-03	5.27E-06	1.72E-08	1.07E+08	2
Y-91	5.70E-05	1.04E-07	3E-05	3E-05	3.45E-03	1.13E-07	2.53E+05	0
Y-93	7.40E-07	1.34E-09	3E-05	3E-05	4.48E-05	1.46E-09	0.00E+00	0
Zr-95	5.10E-05	9.27E-08	6E-05	6E-05	1.54E-03	1.01E-07	1.06E+08	11
Nb-95	5.20E-05	9.45E-08	1E-04	1E-04	9.45E-04	1.03E-07	1.06E+08	11
Mo-99	1.10E-02	2.00E-05	4E-05	4E-05	5.00E-01	2.18E-05	1.41E+08	3069
Tc-99m	1.10E-02	2.00E-05	3E-03	3E-03	6.66E-03	2.18E-05	1.11E+08	2416
Ru-103	3.40E-05	6.18E-08	8E-05	8E-05	7.72E-04	6.73E-08	1.13E+08	8
Ru-106	1.00E-05	1.82E-08	1E-05	1E-05	1.82E-03	1.98E-08	0.00E+00	0
Rh-103m	3.40E-05	6.18E-08	1E-02	1E-02	6.18E-06	6.73E-08	0.00E+00	0
Rh-106	1.00E-05	1.82E-08	0E+00	0E+00	-----	1.98E-08	0.00E+00	0
Te-125m	2.50E-05	4.54E-08	1E-04	1E-04	4.54E-04	4.95E-08	2.40E+05	0
Te-127m	2.60E-04	4.72E-07	5E-05	5E-05	9.45E-03	5.15E-07	1.62E+07	8
Te-127	2.70E-04	4.91E-07	2E-04	2E-04	2.45E-03	5.34E-07	1.48E+06	1
Te-129m	1.10E-03	2.00E-06	2E-05	2E-05	9.99E-02	2.18E-06	1.11E+05	0
Te-129	6.70E-04	1.22E-06	8E-04	8E-04	1.52E-03	1.33E-06	1.69E+07	22
I-130	1.20E-04	2.18E-07	3E-06	3E-06	7.27E-02	2.37E-07	2.65E+08	63
Te-131m	1.60E-04	2.91E-07	4E-05	4E-05	7.27E-03	3.17E-07	1.15E+06	0
Te-131	3.00E-05	5.45E-08	0E+00	0E+00	-----	5.94E-08	1.11E+08	7
I-131	1.60E-01	2.91E-04	3E-07	3E-07	9.69E+02	3.17E-04	1.18E+08	37362
Te-132	4.30E-03	7.81E-06	2E-05	2E-05	3.91E-01	8.51E-06	1.21E+08	1030
I-132	4.90E-03	8.90E-06	8E-06	8E-06	1.11E+00	9.70E-06	3.16E+08	3064
I-133	4.00E-02	7.27E-05	1E-06	1E-06	7.27E+01	7.92E-05	1.16E+08	9182
I-134	8.00E-05	1.45E-07	2E-05	2E-05	7.27E-03	1.58E-07	3.17E+08	50
Cs-134	4.60E-02	8.36E-05	9E-06	9E-06	9.29E+00	9.10E-05	2.42E+08	22029
I-135	4.30E-03	7.81E-06	4E-06	4E-06	1.95E+00	8.51E-06	1.47E+08	1251
Cs-136	8.90E-03	1.62E-05	6E-05	6E-05	2.69E-01	1.76E-05	3.19E+08	5618
Cs-137	3.30E-02	6.00E-05	2E-05	2E-05	3.00E+00	6.53E-05	9.30E+07	6073
Ba-137m	3.10E-02	5.63E-05	2E-05	2E-05	2.82E+00	6.13E-05	9.85E+07	6043
Ba-140	1.10E-04	2.00E-07	2E-05	2E-05	9.99E-03	2.18E-07	4.78E+07	10
La-140	1.10E-04	2.00E-07	2E-05	2E-05	9.99E-03	2.18E-07	2.22E+08	48
Ce-141	5.10E-05	9.27E-08	9E-05	9E-05	1.03E-03	1.01E-07	6.20E+07	6
Ce-143	2.80E-06	5.09E-09	4E-05	4E-05	1.27E-04	5.54E-09	7.87E+07	0
Ce-144	3.20E-05	5.81E-08	1E-05	1E-05	5.81E-03	6.33E-08	1.36E+07	1
Pr-143	2.70E-05	4.91E-08	5E-05	5E-05	9.81E-04	5.34E-08	0.00E+00	0
Pr-144	3.20E-05	5.81E-08	0E+00	0E+00	-----	6.33E-08	2.32E+06	0
H-3	5.50E+02	9.99E-01	3E-03	3E-03	3.33E+02	1.09E+00	0.00E+00	0
All Others	0.00E+00	0.00E+00	3E-06	3E-06	0.00E+00	0.00E+00	0.00E+00	0
Total	5.50E+02	1.00E+00			1.40E+03	1.09E+00		104039
Total H-3	5.50E+02				3.33E+02	1.09E+00		0
Total W/O H-3	4.05E-01				1.06E+03	8.02E-04		104032

Ai: From ODCM 1/2-ODC-2.01 Table 1.1-1a (from Table 13 of S&W UR(B)-160)
Ei: (843-30 Data) From Calc Package No. ERS-SFL-92-039

F = 22800 gpm = Dilution Flowrate (15,000 gpm + 7,800 gpm)
f = 15 gpm = Discharge flowrate
Ct = 1.09E+00 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)
Ci = Si x Ct

CR = Sum (CiEi) = 1.04E+05 cpm
HHSP = CR = 1.04E+05 cpm
HSP = CR x 0.7 = 7.28E+04 cpm

RM-1LW-104 Alarm Setpoints

OLD METHOD - Based on: 1 x Old 10 CFR 20 MPC's

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Nuclide	Ai Annual Release (Ci)	Si	Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	1 x Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	Si/MPC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	1.30E-03	2.36E-06	2E-03	2E-03	1.18E-03	1.10E-06	1.24E+07	14
Mn-54	3.10E-04	5.63E-07	1E-04	1E-04	5.63E-03	2.63E-07	1.05E+08	28
Fe-55	1.60E-03	2.91E-06	8E-04	8E-04	3.63E-03	1.36E-06	0.00E+00	0
Fe-59	8.30E-04	1.51E-06	5E-05	5E-05	3.02E-02	7.04E-07	1.04E+08	73
Co-58	1.40E-02	2.54E-05	9E-05	9E-05	2.83E-01	1.19E-05	1.06E+08	1259
Co-60	2.00E-03	3.63E-06	3E-05	3E-05	1.21E-01	1.70E-06	1.94E+08	329
Zn-65	2.69E-02	4.88E-05	1E-04	1E-04	4.88E-01	2.28E-05	5.02E+07	1143
Np-239	1.40E-04	2.54E-07	1E-04	1E-04	2.54E-03	1.19E-07	0.00E+00	0
Br-83	2.50E-05	4.54E-08	3E-06	3E-06	1.51E-02	2.12E-08	1.48E+06	0
Br-84	2.70E-06	4.91E-09	3E-06	3E-06	1.64E-03	2.29E-09	3.16E+08	1
Br-85	2.80E-08	5.09E-11	0E+00	0E+00	-----	2.37E-11	6.71E+06	0
Rb-86	7.50E-05	1.36E-07	2E-05	2E-05	6.81E-03	6.36E-08	0.00E+00	0
Rb-88	1.20E-04	2.18E-07	0E+00	0E+00	-----	1.02E-07	3.73E+07	4
Sr-89	2.90E-04	5.27E-07	3E-06	3E-06	1.76E-01	2.46E-07	9.84E+03	0
Sr-90	1.10E-05	2.00E-08	3E-07	3E-07	6.66E-02	9.33E-09	0.00E+00	0
Sr-91	9.40E-06	1.71E-08	5E-05	5E-05	3.42E-04	7.97E-09	0.00E+00	0
Y-90	1.30E-05	2.36E-08	2E-05	2E-05	1.18E-03	1.10E-08	8.13E+07	1
Y-91m	8.70E-06	1.58E-08	3E-03	3E-03	5.27E-06	7.38E-09	1.07E+08	1
Y-91	5.70E-05	1.04E-07	3E-05	3E-05	3.45E-03	4.83E-08	2.53E+05	0
Y-93	7.40E-07	1.34E-09	3E-05	3E-05	4.48E-05	6.28E-10	0.00E+00	0
Zr-95	5.10E-05	9.27E-08	6E-05	6E-05	1.54E-03	4.33E-08	1.06E+08	5
Nb-95	5.20E-05	9.45E-08	1E-04	1E-04	9.45E-04	4.41E-08	1.06E+08	5
Mo-99	1.10E-02	2.00E-05	4E-05	4E-05	5.00E-01	9.33E-06	1.41E+08	1315
Tc-99m	1.10E-02	2.00E-05	3E-03	3E-03	6.66E-03	9.33E-06	1.11E+08	1036
Ru-103	3.40E-05	6.18E-08	8E-05	8E-05	7.72E-04	2.88E-08	1.13E+08	3
Ru-106	1.00E-05	1.82E-08	1E-05	1E-05	1.82E-03	8.48E-09	0.00E+00	0
Rh-103m	3.40E-05	6.18E-08	1E-02	1E-02	6.18E-06	2.88E-08	0.00E+00	0
Rh-106	1.00E-05	1.82E-08	0E+00	0E+00	-----	8.48E-09	0.00E+00	0
Te-125m	2.50E-05	4.54E-08	1E-04	1E-04	4.54E-04	2.12E-08	2.40E+05	0
Te-127m	2.60E-04	4.72E-07	5E-05	5E-05	9.45E-03	2.21E-07	1.62E+07	4
Te-127	2.70E-04	4.91E-07	2E-04	2E-04	2.45E-03	2.29E-07	1.48E+06	0
Te-129m	1.10E-03	2.00E-06	2E-05	2E-05	9.99E-02	9.33E-07	1.11E+05	0
Te-129	6.70E-04	1.22E-06	8E-04	8E-04	1.52E-03	5.68E-07	1.69E+07	10
I-130	1.20E-04	2.18E-07	3E-06	3E-06	7.27E-02	1.02E-07	2.65E+08	27
Te-131m	1.60E-04	2.91E-07	4E-05	4E-05	7.27E-03	1.36E-07	1.15E+06	0
Te-131	3.00E-05	5.45E-08	0E+00	0E+00	-----	2.54E-08	1.11E+08	3
I-131	1.60E-01	2.91E-04	3E-07	3E-07	9.69E+02	1.36E-04	1.18E+08	16012
Te-132	4.30E-03	7.81E-06	2E-05	2E-05	3.91E-01	3.65E-06	1.21E+08	441
I-132	4.90E-03	8.90E-06	8E-06	8E-06	1.11E+00	4.16E-06	3.16E+08	1313
I-133	4.00E-02	7.27E-05	1E-06	1E-06	7.27E+01	3.39E-05	1.16E+08	3935
I-134	8.00E-05	1.45E-07	2E-05	2E-05	7.27E-03	6.78E-08	3.17E+08	22
Cs-134	4.60E-02	8.36E-05	9E-06	9E-06	9.29E+00	3.90E-05	2.42E+08	9441
I-135	4.30E-03	7.81E-06	4E-06	4E-06	1.95E+00	3.65E-06	1.47E+08	536
Cs-136	8.90E-03	1.62E-05	6E-05	6E-05	2.69E-01	7.55E-06	3.19E+08	2408
Cs-137	3.30E-02	6.00E-05	2E-05	2E-05	3.00E+00	2.80E-05	9.30E+07	2603
Ba-137m	3.10E-02	5.63E-05	2E-05	2E-05	2.82E+00	2.63E-05	9.85E+07	2590
Ba-140	1.10E-04	2.00E-07	2E-05	2E-05	9.99E-03	9.33E-08	4.78E+07	4
La-140	1.10E-04	2.00E-07	2E-05	2E-05	9.99E-03	9.33E-08	2.22E+08	21
Ce-141	5.10E-05	9.27E-08	9E-05	9E-05	1.03E-03	4.33E-08	6.20E+07	3
Ce-143	2.80E-06	5.09E-09	4E-05	4E-05	1.27E-04	2.37E-09	7.87E+07	0
Ce-144	3.20E-05	5.81E-08	1E-05	1E-05	5.81E-03	2.71E-08	1.36E+07	0
Pr-143	2.70E-05	4.91E-08	5E-05	5E-05	9.81E-04	2.29E-08	0.00E+00	0
Pr-144	3.20E-05	5.81E-08	0E+00	0E+00	-----	2.71E-08	2.32E+06	0
H-3	5.50E+02	9.99E-01	3E-03	3E-03	3.33E+02	4.66E-01	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-07	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	5.50E+02	1.00E+00			1.40E+03	4.67E-01		44588
Total H-3	5.50E+02				3.33E+02	4.66E-01		0
Total W/O H-3	4.05E-01				1.06E+03	3.44E-04		44585

Ai: From ODCM 1/2-ODC-2.01 Table 1.1-1a (from Table 13 of S&W UR(B)-160)
Ei: (843-30 Data) From Calc Package No. ERS-SFL-92-039

F = 22800 gpm = Dilution Flowrate (15,000 gpm + 7,800 gpm)
f = 35 gpm = Discharge flowrate
Ct = 4.67E-01 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)
Ci = Si x Ct

CR = Sum (CiEi) = 4.46E+04 cpm
HHSP = CR = 4.46E+04 cpm
HSP = CR x 0.7 = 3.12E+04 cpm

ERS-ATL-93-021, Rev 3
Attachment 2

2SGC-RQ100 Alarm Setpoints

OLD METHOD - Based on: 1 x Old 10 CFR 20 MPC's

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Nuclide	Ai Annual Release (Ci)	Si	Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	1 x Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	Si/MPC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	1.00E-04	1.82E-07	2E-03	2E-03	9.09E-05	4.83E-08	2.01E+07	1
Mn-54	2.50E-05	4.54E-08	1E-04	1E-04	4.54E-04	1.21E-08	1.27E+08	2
Fe-55	1.30E-04	2.36E-07	8E-04	8E-04	2.95E-04	6.29E-08	0.00E+00	0
Fe-59	6.50E-05	1.18E-07	5E-05	5E-05	2.36E-03	3.14E-08	1.26E+08	4
Co-58	1.10E-03	2.00E-06	9E-05	9E-05	2.22E-02	5.32E-07	1.82E+08	97
Co-60	1.60E-04	2.91E-07	3E-05	3E-05	9.69E-03	7.74E-08	2.38E+08	18
Zn-65	5.10E-02	9.27E-05	1E-04	1E-04	9.27E-01	2.47E-05	6.50E+07	1605
Np-239	3.20E-05	5.82E-08	1E-04	1E-04	5.82E-04	1.55E-08	1.65E+08	3
Br-83	2.90E-05	5.27E-08	3E-06	3E-06	1.76E-02	1.40E-08	2.42E+06	0
Br-84	5.90E-09	1.07E-11	3E-06	3E-06	3.57E-06	2.85E-12	1.38E+08	0
Rb-86	3.70E-05	6.72E-08	2E-05	2E-05	3.36E-03	1.79E-08	1.04E+07	0
Sr-89	2.20E-05	4.00E-08	3E-06	3E-06	1.33E-02	1.06E-08	1.83E+04	0
Sr-90	8.50E-07	1.54E-09	3E-07	3E-07	5.15E-03	4.11E-10	0.00E+00	0
Sr-91	5.30E-06	9.63E-09	5E-05	5E-05	1.93E-04	2.56E-09	1.04E+08	0
Mo-99	2.30E-03	4.18E-06	4E-05	4E-05	1.04E-01	1.11E-06	4.47E+07	50
Tc-99m	2.10E-03	3.82E-06	3E-03	3E-03	1.27E-03	1.02E-06	1.40E+08	142
Te-125m	1.90E-06	3.45E-09	1E-04	1E-04	3.45E-05	9.19E-10	3.94E+05	0
Te-127m	2.10E-05	3.82E-08	5E-05	5E-05	7.63E-04	1.02E-08	1.26E+05	0
Te-127	2.50E-05	4.54E-08	2E-04	2E-04	2.27E-04	1.21E-08	2.43E+06	0
Te-129m	8.20E-05	1.49E-07	2E-05	2E-05	7.45E-03	3.96E-08	6.53E+06	0
Te-129	5.30E-05	9.63E-08	8E-04	8E-04	1.20E-04	2.56E-08	1.96E+07	1
I-130	2.30E-04	4.18E-07	3E-06	3E-06	1.39E-01	1.11E-07	5.18E+08	58
Te-131m	5.20E-05	9.45E-08	4E-05	4E-05	2.36E-03	2.51E-08	2.85E+08	7
Te-131	9.40E-06	1.71E-08	0E+00	0E+00	-----	4.54E-09	1.88E+08	1
I-131	1.00E-01	1.82E-04	3E-07	3E-07	6.06E+02	4.83E-05	1.96E+08	9476
Te-132	7.80E-04	1.42E-06	2E-05	2E-05	7.09E-02	3.77E-07	1.76E+08	66
I-132	2.30E-03	4.18E-06	8E-06	8E-06	5.22E-01	1.11E-06	4.22E+08	469
I-133	6.50E-02	1.18E-04	1E-06	1E-06	1.18E+02	3.14E-05	1.73E+08	5437
I-134	4.60E-06	8.36E-09	2E-05	2E-05	4.18E-04	2.22E-09	4.06E+08	1
Cs-134	3.00E-02	5.45E-05	9E-06	9E-06	6.06E+00	1.45E-05	3.25E+08	4714
I-135	9.20E-03	1.67E-05	4E-06	4E-06	4.18E+00	4.45E-06	1.71E+08	761
Cs-136	3.90E-03	7.09E-06	6E-05	6E-05	1.18E-01	1.89E-06	4.28E+08	807
Cs-137	2.20E-02	4.00E-05	2E-05	2E-05	2.00E+00	1.06E-05	1.28E+08	1361
Ba-140	9.30E-06	1.69E-08	2E-05	2E-05	8.45E-04	4.50E-09	7.50E+07	0
La-140	8.40E-06	1.53E-08	2E-05	2E-05	7.63E-04	4.06E-09	3.08E+08	1
Y-90	6.00E-07	1.09E-09	2E-05	2E-05	5.45E-05	2.90E-10	0.00E+00	0
Y-91m	3.60E-06	6.54E-09	3E-03	3E-03	2.18E-06	1.74E-09	1.59E+08	0
Y-91	4.40E-06	8.00E-09	3E-05	3E-05	2.67E-04	2.13E-09	3.55E+05	0
Y-93	3.00E-07	5.45E-10	3E-05	3E-05	1.82E-05	1.45E-10	2.03E+07	0
Zr-95	4.00E-06	7.27E-09	6E-05	6E-05	1.21E-04	1.93E-09	1.35E+08	0
Nb-95	4.00E-06	7.27E-09	1E-04	1E-04	7.27E-05	1.93E-09	1.33E+08	0
Ru-103	2.70E-06	4.91E-09	8E-05	8E-05	6.13E-05	1.31E-09	1.71E+08	0
Ru-106	8.20E-07	1.49E-09	1E-05	1E-05	1.49E-04	3.96E-10	0.00E+00	0
Rh-103m	2.70E-06	4.91E-09	1E-02	1E-02	4.91E-07	1.31E-09	0.00E+00	0
Rh-106	8.20E-07	1.49E-09	0E+00	0E+00	-----	3.96E-10	5.65E+07	0
Ce-141	4.00E-06	7.27E-09	9E-05	9E-05	8.08E-05	1.93E-09	7.75E+07	0
Ce-143	8.60E-07	1.56E-09	4E-05	4E-05	3.91E-05	4.16E-10	1.20E+08	0
Ce-144	2.60E-06	4.72E-09	1E-05	1E-05	4.72E-04	1.26E-09	1.87E+07	0
Pr-143	2.30E-06	4.18E-09	5E-05	5E-05	8.36E-05	1.11E-09	1.63E+00	0
Pr-144	2.60E-06	4.72E-09	0E+00	0E+00	-----	1.26E-09	3.40E+06	0
H-3	5.50E+02	9.99E-01	3E-03	3E-03	3.33E+02	2.66E-01	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-07	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	5.50E+02	1.00E+00			1.07E+03	2.66E-01		25083
Total H-3	5.50E+02				3.33E+02	2.66E-01		0
Total W/O H-3	2.91E-01				7.38E+02	1.41E-04		25083

Ai: From ODCM 1/2-ODC-2.01 Table 1.1-1b (from Table 13 of S&W UR(B)-160)
Ei: (RD-53 Data) From Calc Package No. ERS-SFL-86-026

F = 22800 gpm = Dilution Flowrate (15,000 gpm + 7,800 gpm)
f = 80 gpm = Discharge flowrate
Ct = 2.66E-01 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)

Ci = Si x Ct

CR = Sum CiEi =	25083	cpm
Eia (W/O H-3) = (CR) / (Sum Ci) =	1.78E+08	cpm/uCi/ml
CF-11 Conversion Factor = 1 / Eia =	5.61E-09	uCi/ml/cpm
DV = CF11 x (Sum CiEi) =	1.41E-04	uCi/ml
HSP = DV =	1.41E-04	uCi/ml
ASP = DV x 0.7 =	9.84E-05	uCi/ml

2SWS-RQ101 & 2SWS-RQ102 Alarm Setpoints

OLD METHOD - Based on: 1 x Old 10 CFR 20 MPC's

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Nuclide	Ai Annual Release (Ci)	Si	Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	1 x Old 10 CFR 20 MPC Appendix B Table II, Col 2 (uCi/ml)	Si/MPC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	2.00E-03	7.51E-04	2E-03	2E-03	3.75E-01	1.58E-09	2.01E+07	0
Mn-54	3.30E-04	1.24E-04	1E-04	1E-04	1.24E+00	2.61E-10	1.27E+08	0
Fe-55	1.70E-03	6.38E-04	8E-04	8E-04	7.97E-01	1.35E-09	0.00E+00	0
Fe-59	1.10E-03	4.13E-04	5E-05	5E-05	8.26E+00	8.71E-10	1.26E+08	0
Co-58	1.70E-02	6.38E-03	9E-05	9E-05	7.09E+01	1.35E-08	1.82E+08	2
Co-60	2.10E-03	7.88E-04	3E-05	3E-05	2.63E-01	1.66E-09	2.38E+08	0
Zn-65	5.10E-02	1.91E-02	1E-04	1E-04	1.91E+02	4.04E-08	6.50E+07	3
Np-239	1.30E-03	4.88E-04	1E-04	1E-04	4.88E+00	1.03E-09	1.65E+08	0
Br-83	5.50E-03	2.06E-03	3E-06	3E-06	6.88E+02	4.35E-09	2.42E+06	0
Br-84	3.00E-03	1.13E-03	3E-06	3E-06	3.75E+02	2.38E-09	1.38E+08	0
Br-85	3.50E-04	1.31E-04	0E+00	0E+00	-----	2.77E-10	9.04E+06	0
Rb-86	9.10E-05	3.41E-05	2E-05	2E-05	1.71E+00	7.20E-11	1.04E+07	0
Rb-88	2.30E-01	8.63E-02	0E+00	0E+00	-----	1.82E-07	4.84E+07	9
Sr-89	3.70E-04	1.39E-04	3E-06	3E-06	4.63E+01	2.93E-10	1.83E+04	0
Sr-90	1.10E-05	4.13E-06	3E-07	3E-07	1.38E+01	8.71E-12	0.00E+00	0
Sr-91	7.20E-04	2.70E-04	5E-05	5E-05	5.40E+00	5.70E-10	1.04E+08	0
Mo-99	9.00E-02	3.38E-02	4E-05	4E-05	8.44E+02	7.13E-08	4.47E+07	3
Tc-99m	5.40E-02	2.03E-02	3E-03	3E-03	6.75E+00	4.28E-08	1.40E+08	6
Te-125m	3.10E-05	1.16E-05	1E-04	1E-04	1.16E-01	2.45E-11	3.94E+05	0
Te-127m	3.00E-04	1.13E-04	5E-05	5E-05	2.25E+00	2.38E-10	1.26E+05	0
Te-127	9.40E-04	3.53E-04	2E-04	2E-04	1.76E+00	7.44E-10	2.43E+06	0
Te-129m	1.50E-03	5.63E-04	2E-05	2E-05	2.81E+01	1.19E-09	6.53E+06	0
Te-129	1.80E-03	6.75E-04	8E-04	8E-04	8.44E-01	1.43E-09	1.96E+07	0
I-130	2.30E-03	8.63E-04	3E-06	3E-06	2.88E+02	1.82E-09	5.18E+08	1
Te-131m	2.70E-03	1.01E-03	4E-05	4E-05	2.53E+01	2.14E-09	2.85E+08	1
Te-131	1.30E-03	4.88E-04	0E+00	0E+00	-----	1.03E-09	1.88E+08	0
I-131	2.90E-01	1.09E-01	3E-07	3E-07	3.63E+05	2.30E-07	1.96E+08	45
Te-132	2.90E-02	1.09E-02	2E-05	2E-05	5.44E+02	2.30E-08	1.76E+08	4
I-132	1.10E-01	4.13E-02	8E-06	8E-06	5.16E+03	8.71E-08	4.22E+08	37
I-133	4.20E-01	1.58E-01	1E-06	1E-06	1.58E+05	3.33E-07	1.73E+08	58
I-134	5.40E-02	2.03E-02	2E-05	2E-05	1.01E+03	4.28E-08	4.06E+08	17
Cs-134	2.70E-02	1.01E-02	9E-06	9E-06	1.13E+03	2.14E-08	3.25E+08	7
I-135	2.10E-01	7.88E-02	4E-06	4E-06	1.97E+04	1.66E-07	1.71E+08	28
Cs-136	1.40E-02	5.25E-03	6E-05	6E-05	8.76E+01	1.11E-08	4.28E+08	5
Cs-137	1.90E-02	7.13E-03	2E-05	2E-05	3.56E+02	1.50E-08	1.28E+08	2
Ba-137m	1.90E-02	7.13E-03	2E-05	2E-05	3.56E+02	1.50E-08	1.33E+08	2
Ba-140	2.30E-04	8.63E-05	2E-05	2E-05	4.32E+00	1.82E-10	7.50E+07	0
La-140	1.60E-04	6.00E-05	2E-05	2E-05	3.00E+00	1.27E-10	3.08E+08	0
Y-90	1.30E-06	4.88E-07	2E-05	2E-05	2.44E-02	1.03E-12	0.00E+00	0
Y-91m	4.20E-04	1.58E-04	3E-03	3E-03	5.25E-02	3.33E-10	1.59E+08	0
Y-91	6.80E-05	2.55E-05	3E-05	3E-05	8.51E-01	5.38E-11	3.55E+05	0
Y-93	3.80E-05	1.43E-05	3E-05	3E-05	4.75E-01	3.01E-11	2.03E+07	0
Zr-95	6.30E-05	2.36E-05	6E-05	6E-05	3.94E-01	4.99E-11	1.35E+08	0
Nb-95	5.30E-05	1.99E-05	1E-04	1E-04	1.99E-01	4.20E-11	1.33E+08	0
Ru-103	4.70E-05	1.76E-05	8E-05	8E-05	2.20E-01	3.72E-11	1.71E+08	0
Ru-106	1.10E-05	4.13E-06	1E-05	1E-05	4.13E-01	8.71E-12	0.00E+00	0
Rh-103m	5.20E-05	1.95E-05	1E-02	1E-02	1.95E-03	4.12E-11	0.00E+00	0
Rh-106	1.20E-05	4.50E-06	0E+00	0E+00	-----	9.50E-12	5.65E+07	0
Ce-141	7.40E-05	2.78E-05	9E-05	9E-05	3.09E-01	5.86E-11	7.75E+07	0
Ce-143	4.30E-05	1.61E-05	4E-05	4E-05	4.03E-01	3.40E-11	1.20E+08	0
Ce-144	3.50E-05	1.31E-05	1E-05	1E-05	1.31E+00	2.77E-11	1.87E+07	0
Pr-143	5.30E-05	1.99E-05	5E-05	5E-05	3.98E-01	4.20E-11	1.63E+00	0
Pr-144	3.80E-05	1.43E-05	0E+00	0E+00	-----	3.01E-11	3.40E+06	0
H-3	1.00E+00	3.75E-01	3E-03	3E-03	1.25E+02	7.92E-07	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-07	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	2.66E+00	1.00E+00			5.51E+05	2.11E-06		231
Total H-3	1.00E+00				1.25E+02	7.92E-07		0
Total W/O H-3	1.66E+00				5.51E+05	1.32E-06		231

Ai: From S & W Calc Package No. UR(B) 299-0
Ei: (RD-53 Data) From Calc Package No. ERS-SFL-86-026

F = 8400 gpm = Dilution Flowrate
f = 7220 gpm = Discharge flowrate
Ct = 2.11E-06 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)

Ci = Si x Ct

CR = Sum CiEi =	231	cpm
Eia (W/O H-3) = (CR) / (Sum Ci) =	1.75E+08	cpm/uCi/ml
CF-11 Conversion Factor = 1 / Eia =	5.71E-09	uCi/ml/cpm
DV = CF11 x (Sum CiEi) =	1.32E-06	uCi/ml
HSP = DV =	1.32E-06	uCi/ml
ASP = DV x 0.7 =	9.23E-07	uCi/ml

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RM-1RW-100 Alarm Setpoints

NEW METHOD - Based on: 10 x New 10 CFR 20 EC's

Nuclide	Ai Annual Release (Ci)	Si	New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	10 x New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	Si/EC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	0.00E+00	0.00E+00	5E-04	5E-03	0.00E+00	0.00E+00	1.24E+07	0
Co-58	4.86E+00	1.19E-03	2E-05	2E-04	5.94E+00	3.59E-07	1.06E+08	38
Co-60	1.46E-01	3.57E-05	3E-06	3E-05	1.19E+00	1.08E-08	1.94E+08	2
Rb-88	6.21E+02	1.52E-01	4E-04	4E-03	3.79E+01	4.58E-05	3.73E+07	1710
Sr-89	7.83E-01	1.91E-04	8E-06	8E-05	2.39E+00	5.78E-08	9.84E+03	0
Sr-90	1.86E-02	4.55E-06	5E-07	5E-06	9.09E-01	1.37E-09	0.00E+00	0
Y-90	2.27E-02	5.55E-06	7E-06	7E-05	7.93E-02	1.68E-09	0.00E+00	0
Sr-91	3.78E-01	9.24E-05	2E-05	2E-04	4.62E-01	2.79E-08	8.13E+07	2
Y-91	1.27E-01	3.10E-05	8E-06	8E-05	3.88E-01	9.38E-09	2.53E+05	0
Zr-95	1.32E-01	3.23E-05	2E-05	2E-04	1.61E-01	9.75E-09	1.06E+08	1
Nb-95	1.32E-01	3.23E-05	3E-05	3E-04	1.08E-01	9.75E-09	1.06E+08	1
Zr-97	7.56E-02	1.85E-05	9E-06	9E-05	2.05E-01	5.58E-09	1.17E+08	1
Mo-99	6.21E+02	1.52E-01	2E-05	2E-04	7.59E+02	4.58E-05	1.41E+08	6464
Tc-99m	3.51E+02	8.58E-02	1E-03	1E-02	8.58E+00	2.59E-05	1.11E+08	2876
Ru-103	6.48E-02	1.58E-05	3E-05	3E-04	5.28E-02	4.78E-09	1.13E+08	1
Ru-105	5.67E-03	1.39E-06	7E-05	7E-04	1.98E-03	4.19E-10	7.84E+07	0
Ru-106	4.32E-03	1.06E-06	3E-06	3E-05	3.52E-02	3.19E-10	0.00E+00	0
Rh-105	1.62E-02	3.96E-06	5E-05	5E-04	7.92E-03	1.20E-09	3.07E+07	0
Te-127m	3.51E-01	8.58E-05	9E-06	9E-05	9.53E-01	2.59E-08	1.62E+07	0
Te-127	1.92E-01	4.69E-05	1E-04	1E-03	4.69E-02	1.42E-08	1.48E+06	0
Sb-127	2.67E-03	6.53E-07	1E-05	1E-04	6.53E-03	1.97E-10	1.25E+08	0
Sb-129	6.21E-03	1.52E-06	4E-05	4E-04	3.79E-03	4.58E-10	1.47E+08	0
Te-129m	7.29E+00	1.78E-03	7E-06	7E-05	2.55E+01	5.38E-07	1.11E+05	0
Te-129	4.05E+00	9.90E-04	4E-04	4E-03	2.47E-01	2.99E-07	1.69E+07	5
Te-131m	4.32E+00	1.06E-03	8E-06	8E-05	1.32E+01	3.19E-07	1.15E+06	0
I-131	4.86E+02	1.19E-01	1E-06	1E-05	1.19E+04	3.59E-05	1.18E+08	4234
Te-132	5.13E+01	1.25E-02	9E-06	9E-05	1.39E+02	3.79E-06	1.21E+08	458
I-132	1.70E+02	4.16E-02	1E-04	1E-03	4.16E+01	1.26E-05	3.16E+08	3966
I-133	7.83E+02	1.91E-01	7E-06	7E-05	2.73E+03	5.78E-05	1.16E+08	6706
I-134	1.05E+02	2.57E-02	4E-04	4E-03	6.42E+00	7.75E-06	3.17E+08	2457
I-135	4.05E+02	9.90E-02	3E-05	3E-04	3.30E+02	2.99E-05	1.47E+08	4395
Cs-137	2.46E+02	6.01E-02	1E-06	1E-05	6.01E+03	1.82E-05	9.30E+07	1689
Ba-137m	2.27E+02	5.55E-02	1E-06	1E-05	5.55E+03	1.68E-05	9.85E+07	1651
Ba-140	8.10E-01	1.98E-04	8E-06	8E-05	2.47E+00	5.98E-08	4.78E+07	3
La-140	2.97E-01	7.26E-05	9E-06	9E-05	8.07E-01	2.19E-08	2.22E+08	5
Ce-141	1.30E-01	3.18E-05	3E-05	3E-04	1.06E-01	9.60E-09	6.20E+07	1
Ce-143	9.72E-02	2.38E-05	2E-05	2E-04	1.19E-01	7.18E-09	7.87E+07	1
Ce-144	6.75E-02	1.65E-05	3E-06	3E-05	5.50E-01	4.98E-09	1.36E+07	0
Pr-143	1.27E-01	3.10E-05	2E-05	2E-04	1.55E-01	9.38E-09	0.00E+00	0
Pr-144	6.75E-02	1.65E-05	6E-04	6E-03	2.75E-03	4.98E-09	2.32E+06	0
Nd-147	4.59E-02	1.12E-05	2E-05	2E-04	5.61E-02	3.39E-09	3.37E+07	0
H-3	0.00E+00	0.00E+00	1E-03	1E-02	0.00E+00	0.00E+00	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-08	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	4.09E+03	1.00E+00			2.76E+04	3.02E-04		36667
Total H-3	0.00E+00				0.00E+00	0.00E+00		0
Total W/O H-3	4.09E+03				2.76E+04	3.02E-04		36667

Ai: RCS Activity, From Calc Package No. ERS-SFL-92-037
Ei: (843-30 Data) From Calc Package No. ERS-SFL-92-039

F = 149800 gpm = Dilution Flowrate (127,000 gpm + 15,000 gpm + 7,800 gpm)
f = 18000 gpm = Discharge flowrate (9,000 gpm / RPRWP: Assumes 2 RPRWPs operating)
Ct = 3.02E-04 = Dilution Flowrate / (Discharge Flowrate x Sum *Si/MPC*)
Ci = Si x Ct

CR = Sum (CiEi) = 3.67E+04 cpm
HHSP = CR = 3.67E+04 cpm
HSP = CR x 0.7 = 2.57E+04 cpm

ERS-ATL-93-021, Rev 3
Attachment 3

RM-1RW-101 Alarm Setpoints

NEW METHOD - Based on: 10 x New 10 CFR 20 EC's

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Nuclide	Ai Annual Release (Ci)	Si	New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	10 x New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	Si/EC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	1.30E-03	2.36E-06	5E-04	5E-03	4.72E-04	2.57E-07	1.24E+07	3
Mn-54	3.10E-04	5.63E-07	3E-05	3E-04	1.88E-03	6.14E-08	1.05E+08	6
Fe-55	1.60E-03	2.91E-06	1E-04	1E-03	2.91E-03	3.17E-07	0.00E+00	0
Fe-59	8.30E-04	1.51E-06	1E-05	1E-04	1.51E-02	1.64E-07	1.04E+08	17
Co-58	1.40E-02	2.54E-05	2E-05	2E-04	1.27E-01	2.77E-06	1.06E+08	294
Co-60	2.00E-03	3.63E-06	3E-06	3E-05	1.21E-01	3.96E-07	1.94E+08	77
Zn-65	2.69E-02	4.88E-05	5E-06	5E-05	9.76E-01	5.32E-06	5.02E+07	267
Np-239	1.40E-04	2.54E-07	2E-05	2E-04	1.27E-03	2.77E-08	0.00E+00	0
Br-83	2.50E-05	4.54E-08	9E-04	9E-03	5.05E-06	4.95E-09	1.48E+06	0
Br-84	2.70E-06	4.91E-09	4E-04	4E-03	1.23E-06	5.35E-10	3.16E+08	0
Br-85	2.80E-08	5.09E-11	0E+00	0E+00	-----	5.54E-12	6.71E+06	0
Rb-86	7.50E-05	1.36E-07	7E-06	7E-05	1.95E-03	1.48E-08	0.00E+00	0
Rb-88	1.20E-04	2.18E-07	4E-04	4E-03	5.45E-05	2.38E-08	3.73E+07	1
Sr-89	2.90E-04	5.27E-07	8E-06	8E-05	6.59E-03	5.74E-08	9.84E+03	0
Sr-90	1.10E-05	2.00E-08	5E-07	5E-06	4.00E-03	2.18E-09	0.00E+00	0
Y-90	9.40E-06	1.71E-08	7E-06	7E-05	2.44E-04	1.86E-09	0.00E+00	0
Sr-91	1.30E-05	2.36E-08	2E-05	2E-04	1.18E-04	2.57E-09	8.13E+07	0
Y-91m	8.70E-06	1.58E-08	2E-03	2E-02	7.90E-07	1.72E-09	1.07E+08	0
Y-91	5.70E-05	1.04E-07	8E-06	8E-05	1.29E-03	1.13E-08	2.53E+05	0
Y-93	7.40E-07	1.34E-09	2E-05	2E-04	6.72E-06	1.47E-10	0.00E+00	0
Zr-95	5.10E-05	9.27E-08	2E-05	2E-04	4.63E-04	1.01E-08	1.06E+08	1
Nb-95	5.20E-05	9.45E-08	3E-05	3E-04	3.15E-04	1.03E-08	1.06E+08	1
Mo-99	1.10E-02	2.00E-05	2E-05	2E-04	9.99E-02	2.18E-06	1.41E+08	307
Tc-99m	1.10E-02	2.00E-05	1E-03	1E-02	2.00E-03	2.18E-06	1.11E+08	242
Ru-103	3.40E-05	6.18E-08	3E-05	3E-04	2.06E-04	6.73E-09	1.13E+08	1
Ru-106	1.00E-05	1.82E-08	3E-06	3E-05	6.06E-04	1.98E-09	0.00E+00	0
Rh-103m	3.40E-05	6.18E-08	6E-03	6E-02	1.03E-06	6.73E-09	0.00E+00	0
Rh-106	1.00E-05	1.82E-08	0E+00	0E+00	-----	1.98E-09	0.00E+00	0
Te-125m	2.50E-05	4.54E-08	2E-05	2E-04	2.27E-04	4.95E-09	2.40E+05	0
Te-127m	2.60E-04	4.72E-07	9E-06	9E-05	5.25E-03	5.15E-08	1.62E+07	1
Te-127	2.70E-04	4.91E-07	1E-04	1E-03	4.91E-04	5.35E-08	1.48E+06	0
Te-129m	1.10E-03	2.00E-06	7E-06	7E-05	2.86E-02	2.18E-07	1.11E+05	0
Te-129	6.70E-04	1.22E-06	4E-04	4E-03	3.04E-04	1.33E-07	1.69E+07	2
I-130	1.20E-04	2.18E-07	2E-05	2E-04	1.09E-03	2.38E-08	2.65E+08	6
Te-131m	1.60E-04	2.91E-07	8E-06	8E-05	3.63E-03	3.17E-08	1.15E+06	0
Te-131	3.00E-05	5.45E-08	8E-05	8E-04	6.81E-05	5.94E-09	1.11E+08	1
I-131	1.60E-01	2.91E-04	1E-06	1E-05	2.91E+01	3.17E-05	1.18E+08	3738
Te-132	4.30E-03	7.81E-06	9E-06	9E-05	8.68E-02	8.51E-07	1.21E+08	103
I-132	4.90E-03	8.90E-06	1E-04	1E-03	8.90E-03	9.70E-07	3.16E+08	307
I-133	4.00E-02	7.27E-05	7E-06	7E-05	1.04E+00	7.92E-06	1.16E+08	919
I-134	8.00E-05	1.45E-07	4E-04	4E-03	3.63E-05	1.58E-08	3.17E+08	5
Cs-134	4.60E-02	8.36E-05	9E-07	9E-06	9.29E+00	9.11E-06	2.42E+08	2204
I-135	4.30E-03	7.81E-06	3E-05	3E-04	2.60E-02	8.51E-07	1.47E+08	125
Cs-136	8.90E-03	1.62E-05	6E-06	6E-05	2.69E-01	1.76E-06	3.19E+08	562
Cs-137	3.30E-02	6.00E-05	1E-06	1E-05	6.00E+00	6.53E-06	9.30E+07	608
Ba-137m	3.10E-02	5.63E-05	1E-06	1E-05	5.63E+00	6.14E-06	9.85E+07	605
Ba-140	1.10E-04	2.00E-07	8E-06	8E-05	2.50E-03	2.18E-08	4.78E+07	1
La-140	1.10E-04	2.00E-07	9E-06	9E-05	2.22E-03	2.18E-08	2.22E+08	5
Ce-141	5.10E-05	9.27E-08	3E-05	3E-04	3.09E-04	1.01E-08	6.20E+07	1
Ce-143	2.80E-06	5.09E-09	2E-05	2E-04	2.54E-05	5.54E-10	7.87E+07	0
Ce-144	3.20E-05	5.81E-08	3E-06	3E-05	1.94E-03	6.34E-09	1.36E+07	0
Pr-143	2.70E-05	4.91E-08	2E-05	2E-04	2.45E-04	5.35E-09	0.00E+00	0
Pr-144	3.20E-05	5.81E-08	6E-04	6E-03	9.69E-06	6.34E-09	2.32E+06	0
H-3	5.50E+02	9.99E-01	1E-03	1E-02	9.99E+01	1.09E-01	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-08	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	5.50E+02	1.00E+00			1.53E+02	1.09E-01		10408
Total H-3	5.50E+02				9.99E+01	1.09E-01		0
Total W/O H-3	4.05E-01				5.28E+01	8.02E-05		10408

Ai: From ODCM 1/2-ODC-2.01 Table 1.1-1a (from Table 13 of S&W UR(B)-160)
Ei: (843-30 Data) From Calc Package No. ERS-SFL-92-039

P = 149800 gpm = Dilution Flowrate (127,000 gpm + 15,000 gpm + 7,800 gpm)
f = 9000 gpm = Disch. flowrate (9,000 gpm / RPRWP: With 2 RPRWPs, flow is split between CCW & RSP)
Ct = 1.09E-01 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)
Ci = Si x Ct

CR = Sum (CiEi) = 1.04E+04 cpm
HHSP = CR = 1.04E+04 cpm
HSP = CR x 0.7 = 7.29E+03 cpm

RM-1DA-100 Alarm Setpoints (Model 843-32 Detector)

NEW METHOD - Based on: 10 x New 10 CFR 20 EC's

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Nuclide	Ai Annual Release (Ci)	Si	New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	10 x New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	Si/EC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	0.00E+00	0.00E+00	5E-04	5E-03	0.00E+00	0.00E+00	1.18E+07	0
I-131	1.33E+02	2.60E-01	1E-06	1E-05	2.60E+04	2.10E-05	1.11E+08	2329
I-132	4.77E+01	9.33E-02	1E-04	1E-03	9.33E+01	7.53E-06	2.66E+08	2002
I-133	1.97E+02	3.86E-01	7E-06	7E-05	5.51E+03	3.11E-05	9.90E+07	3077
I-134	2.33E+01	4.56E-02	4E-04	4E-03	1.14E+01	3.68E-06	2.70E+08	993
I-135	1.10E+02	2.15E-01	3E-05	3E-04	7.18E+02	1.74E-05	1.19E+08	2065
H-3	0.00E+00	0.00E+00	1E-03	1E-02	0.00E+00	0.00E+00	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-08	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	5.11E+02	1.00E+00			3.24E+04	8.06E-05		10466
Total H-3	0.00E+00				0.00E+00	0.00E+00		0
Total W/O H-3	5.11E+02				3.24E+04	8.06E-05		10466

Ei: (843-30R Data) From Calc Package No. ERS-SFL-92-039

NOTE: Even though this monitor has a Model 843-32 detector, the vendor notes that the efficiencies are the same as those for the Model 843-30 detector.

F = 86.9 gpm = Dilution Flowrate (Total from Outfall 003), as follows:
- 23.8 gpm = 0.0342 MGD from Internal Outfall 103 (Reference: 1/2-ADM-0604)
- 38.9 gpm = 0.056 MGD from Internal Outfall 303 (Reference: 1/2-ADM-0604)
- 24.3 gpm = 35,000 gpd from Secondary Make-up (Reference: Form 1/2-ENV-05.04.F04)

f = 33.3 pgm = Discharge flowrate from Aux Feed Pump Drains to Internal Outfall 303 as follows:
- 33.3 gpm = Internal Outfall 303 Adjusted for Aux Feed Drain (i.e., 38.9 gpm x 86%)

Ct = 8.06E-05 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)

Ci = Si x Ct

CR = Sum (CiEi) = 1.05E+04 cpm

HHSP = CR = 1.05E+04 cpm

HSP = CR x 0.7 = 7.33E+03 cpm

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Attachment 3

RM-1DA-100 Alarm Setpoints (Model 843-32R Detector)

NEW METHOD - Based on: 10 x New 10 CFR 20 EC's

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Nuclide	Ai Annual Release (Ci)	Si	New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	10 x New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	Si/EC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	0.00E+00	0.00E+00	5E-04	5E-03	0.00E+00	0.00E+00	0.00E+00	0
I-131	1.33E+02	2.60E-01	1E-06	1E-05	2.60E+04	2.10E-05	1.18E+08	2476
I-132	4.77E+01	9.33E-02	1E-04	1E-03	9.33E+01	7.53E-06	3.16E+08	2378
I-133	1.97E+02	3.86E-01	7E-06	7E-05	5.51E+03	3.11E-05	1.16E+08	3606
I-134	2.33E+01	4.56E-02	4E-04	4E-03	1.14E+01	3.68E-06	3.17E+08	1165
I-135	1.10E+02	2.15E-01	3E-05	3E-04	7.18E+02	1.74E-05	1.47E+08	2551
H-3	0.00E+00	0.00E+00	1E-03	1E-02	0.00E+00	0.00E+00	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-08	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	5.11E+02	1.00E+00			3.24E+04	8.06E-05		12177
Total H-3	0.00E+00				0.00E+00	0.00E+00		0
Total W/O H-3	5.11E+02				3.24E+04	8.06E-05		12177

Ei: (843-30R Data) From Calc Package No. ERS-SFL-92-039
NOTE: Even though this monitor has a Model 843-32R detector, the vendor notes that the efficiencies are the same as those for the Model 843-30R detector.

F = 86.9 gpm = Dilution Flowrate (Total from Outfall 003), as follows:
23.8 gpm = 0.0342 MGD from Internal Outfall 103 (Reference: 1/2-ADM-0604)
38.9 gpm = 0.056 MGD from Internal Outfall 303 (Reference: 1/2-ADM-0604)
24.3 gpm = 35,000 gpd from Secondary Make-up (Reference: Form 1/2-ENV-05.04.F04)

f = 33.3 pgm = Discharge flowrate from Aux Feed Pump Drains to Internal Outfall 303 as follows:
33.3 gpm = Internal Outfall 303 Adjusted for Aux Feed Drain (i.e., 38.9 gpm x 86%)

Ct = 8.06E-05 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)
Ci = Si x Ct

CR = Sum (CiEi) = 1.22E+04 cpm
HHSP = CR = 1.22E+04 cpm
HSP = CR x 0.7 = 8.52E+03 cpm

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RM-1LW-116 Alarm Setpoints   New Method - Based on: 10 x New 10 CFR 20 EC's

Nuclide	Ai Annual Release (Ci)	Si	New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	10 x New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	Si/EC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	1.30E-03	2.36E-06	5E-04	5E-03	4.72E-04	2.35E-05	1.24E+07	291
Mn-54	3.10E-04	5.63E-07	3E-05	3E-04	1.88E-03	5.60E-06	1.05E+08	588
Fe-55	1.60E-03	2.91E-06	1E-04	1E-03	2.91E-03	2.89E-05	0.00E+00	0
Fe-59	8.30E-04	1.51E-06	1E-05	1E-04	1.51E-02	1.50E-05	1.04E+08	1561
Co-58	1.40E-02	2.54E-05	2E-05	2E-04	1.27E-01	2.53E-04	1.06E+08	26830
Co-60	2.00E-03	3.63E-06	3E-06	3E-05	1.21E-01	3.62E-05	1.94E+08	7015
Zn-65	2.69E-02	4.88E-05	5E-06	5E-05	9.76E-01	4.86E-04	5.02E+07	24375
Np-239	1.40E-04	2.54E-07	2E-05	2E-04	1.27E-03	2.53E-06	0.00E+00	0
Br-83	2.50E-05	4.54E-08	9E-04	9E-03	5.05E-06	4.52E-07	1.48E+06	1
Br-84	2.70E-06	4.91E-09	4E-04	4E-03	1.23E-06	4.88E-08	3.16E+08	15
Br-85	2.80E-08	5.09E-11	0E+00	0E+00	-----	5.06E-10	6.71E+06	0
Rb-86	7.50E-05	1.36E-07	7E-06	7E-05	1.95E-03	1.36E-06	0.00E+00	0
Rb-88	1.20E-04	2.18E-07	4E-04	4E-03	5.45E-05	2.17E-06	3.73E+07	81
Sr-89	2.90E-04	5.27E-07	8E-06	8E-05	6.59E-03	5.24E-06	9.84E+03	0
Sr-90	1.10E-05	2.00E-08	5E-07	5E-06	4.00E-03	1.99E-07	0.00E+00	0
Sr-91	9.40E-06	1.71E-08	2E-05	2E-04	8.54E-05	1.70E-07	0.00E+00	0
Y-90	1.30E-05	2.36E-08	7E-06	7E-05	3.37E-04	2.35E-07	8.13E+07	19
Y-91m	8.70E-06	1.58E-08	2E-03	2E-02	7.90E-07	1.57E-07	1.07E+08	17
Y-91	5.70E-05	1.04E-07	8E-06	8E-05	1.29E-03	1.03E-06	2.53E+05	0
Y-93	7.40E-07	1.34E-09	2E-05	2E-04	6.72E-06	1.34E-08	0.00E+00	0
Zr-95	5.10E-05	9.27E-08	2E-05	2E-04	4.63E-04	9.22E-07	1.06E+08	98
Nb-95	5.20E-05	9.45E-08	3E-05	3E-04	3.15E-04	9.40E-07	1.06E+08	100
Mo-99	1.10E-02	2.00E-05	2E-05	2E-04	9.99E-02	1.99E-04	1.41E+08	28041
Tc-99m	1.10E-02	2.00E-05	1E-03	1E-02	2.00E-03	1.99E-04	1.11E+08	22075
Ru-103	3.40E-05	6.18E-08	3E-05	3E-04	2.06E-04	6.15E-07	1.13E+08	69
Ru-106	1.00E-05	1.82E-08	3E-06	3E-05	6.06E-04	1.81E-07	0.00E+00	0
Rh-103m	3.40E-05	6.18E-08	6E-03	6E-02	1.03E-06	6.15E-07	0.00E+00	0
Rh-106	1.00E-05	1.82E-08	0E+00	0E+00	-----	1.81E-07	0.00E+00	0
Te-125m	2.50E-05	4.54E-08	2E-05	2E-04	2.27E-04	4.52E-07	2.40E+05	0
Te-127m	2.60E-04	4.72E-07	9E-06	9E-05	5.25E-03	4.70E-06	1.62E+07	76
Te-127	2.70E-04	4.91E-07	1E-04	1E-03	4.91E-04	4.88E-06	1.48E+06	7
Te-129m	1.10E-03	2.00E-06	7E-06	7E-05	2.86E-02	1.99E-05	1.11E+05	2
Te-129	6.70E-04	1.22E-06	4E-04	4E-03	3.04E-04	1.21E-05	1.69E+07	205
I-130	1.20E-04	2.18E-07	2E-05	2E-04	1.09E-03	2.17E-06	2.65E+08	575
Te-131m	1.60E-04	2.91E-07	8E-06	8E-05	3.63E-03	2.89E-06	1.15E+06	3
Te-131	3.00E-05	5.45E-08	8E-05	8E-04	6.81E-05	5.42E-07	1.11E+08	60
I-131	1.60E-01	2.91E-04	1E-06	1E-05	2.91E+01	2.89E-03	1.18E+08	341336
Te-132	4.30E-03	7.81E-06	9E-06	9E-05	8.68E-02	7.77E-05	1.21E+08	9407
I-132	4.90E-03	8.90E-06	1E-04	1E-03	8.90E-03	8.86E-05	3.16E+08	27994
I-133	4.00E-02	7.27E-05	7E-06	7E-05	1.04E+00	7.23E-04	1.16E+08	83888
I-134	8.00E-05	1.45E-07	4E-04	4E-03	3.63E-05	1.45E-06	3.17E+08	458
Cs-134	4.60E-02	8.36E-05	9E-07	9E-06	9.29E+00	8.32E-04	2.42E+08	201258
I-135	4.30E-03	7.81E-06	3E-05	3E-04	2.60E-02	7.77E-05	1.47E+08	11428
Cs-136	8.90E-03	1.62E-05	6E-06	6E-05	2.69E-01	1.61E-04	3.19E+08	51329
Cs-137	3.30E-02	6.00E-05	1E-06	1E-05	6.00E+00	5.97E-04	9.30E+07	55485
Ba-137m	3.10E-02	5.63E-05	1E-06	1E-05	5.63E+00	5.60E-04	9.85E+07	55205
Ba-140	1.10E-04	2.00E-07	8E-06	8E-05	2.50E-03	1.99E-06	4.78E+07	95
La-140	1.10E-04	2.00E-07	9E-06	9E-05	2.22E-03	1.99E-06	2.22E+08	441
Ce-141	5.10E-05	9.27E-08	3E-05	3E-04	3.09E-04	9.22E-07	6.20E+07	57
Ce-143	2.80E-06	5.09E-09	2E-05	2E-04	2.54E-05	5.06E-08	7.87E+07	4
Ce-144	3.20E-05	5.81E-08	3E-06	3E-05	1.94E-03	5.79E-07	1.36E+07	8
Pr-143	2.70E-05	4.91E-08	2E-05	2E-04	2.45E-04	4.88E-07	0.00E+00	0
Pr-144	3.20E-05	5.81E-08	6E-04	6E-03	9.69E-06	5.79E-07	2.32E+06	1
H-3	5.50E+02	9.99E-01	1E-03	1E-02	9.99E+01	9.94E+00	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-08	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	5.50E+02	1.00E+00			1.53E+02	9.95E+00		950500
Total H-3	5.50E+02				9.99E+01	9.94E+00		0
Total W/O H-3	4.05E-01				5.28E+01	7.33E-03		950429

Ai: From ODCM 1/2-ODC-2.01 Table 1.1-1a (from Table 13 of S&W UR(B)-160)
Ei: (843-30 Data) From Calc Package No. BRS-SFL-92-039

F = 22800 gpm = Dilution Flowrate (15,000 gpm + 7,800 gpm)
f = 15 gpm = Discharge flowrate
Ct = 9.95E+00 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)
Ci = Si x Ct

CR = Sum (CiEi) = 9.50E+05 cpm
HHSP = CR = 9.50E+05 cpm
HSP = CR X 0.7 = 6.65E+05 cpm

RM-1LW-104 Alarm Setpoints

NEW METHOD - Based on: 10 x New 10 CFR 20 EC's

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Nuclide	Ai Annual Release (Ci)	Si	New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	10 x New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	Si/EC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	1.30E-03	2.36E-06	5E-04	5E-03	4.72E-04	1.01E-05	1.24E+07	125
Mn-54	3.10E-04	5.63E-07	3E-05	3E-04	1.88E-03	2.40E-06	1.05E+08	252
Fe-55	1.60E-03	2.91E-06	1E-04	1E-03	2.91E-03	1.24E-05	0.00E+00	0
Fe-59	8.30E-04	1.51E-06	1E-05	1E-04	1.51E-02	6.43E-06	1.04E+08	669
Co-58	1.40E-02	2.54E-05	2E-05	2E-04	1.27E-01	1.08E-04	1.06E+08	11498
Co-60	2.00E-03	3.63E-06	3E-06	3E-05	1.21E-01	1.55E-05	1.94E+08	3006
Zn-65	2.69E-02	4.88E-05	5E-06	5E-05	9.76E-01	2.08E-04	5.02E+07	10446
Np-239	1.40E-04	2.54E-07	2E-05	2E-04	1.27E-03	1.08E-06	0.00E+00	0
Br-83	2.50E-05	4.54E-08	9E-04	9E-03	5.05E-06	1.94E-07	1.48E+06	0
Br-84	2.70E-06	4.91E-09	4E-04	4E-03	1.23E-06	2.09E-08	3.16E+08	7
Br-85	2.80E-08	5.09E-11	0E+00	0E+00	-----	2.17E-10	6.71E+06	0
Rb-86	7.50E-05	1.36E-07	7E-06	7E-05	1.95E-03	5.81E-07	0.00E+00	0
Rb-88	1.20E-04	2.18E-07	4E-04	4E-03	5.45E-05	9.30E-07	3.73E+07	35
Sr-89	2.90E-04	5.27E-07	8E-06	8E-05	6.59E-03	2.25E-06	9.84E+03	0
Sr-90	1.10E-05	2.00E-08	5E-07	5E-06	4.00E-03	8.52E-08	0.00E+00	0
Sr-91	9.40E-06	1.71E-08	2E-05	2E-04	8.54E-05	7.28E-08	0.00E+00	0
Y-90	1.30E-05	2.36E-08	7E-06	7E-05	3.37E-04	1.01E-07	8.13E+07	8
Y-91m	8.70E-06	1.58E-08	2E-03	2E-02	7.90E-07	6.74E-08	1.07E+08	7
Y-91	5.70E-05	1.04E-07	8E-06	8E-05	1.29E-03	4.42E-07	2.53E+05	0
Y-93	7.40E-07	1.34E-09	2E-05	2E-04	6.72E-06	5.73E-09	0.00E+00	0
Zr-95	5.10E-05	9.27E-08	2E-05	2E-04	4.63E-04	3.95E-07	1.06E+08	42
Nb-95	5.20E-05	9.45E-08	3E-05	3E-04	3.15E-04	4.03E-07	1.06E+08	43
Mo-99	1.10E-02	2.00E-05	2E-05	2E-04	9.99E-02	8.52E-05	1.41E+08	12018
Tc-99m	1.10E-02	2.00E-05	1E-03	1E-02	2.00E-03	8.52E-05	1.11E+08	9461
Ru-103	3.40E-05	6.18E-08	3E-05	3E-04	2.06E-04	2.63E-07	1.13E+08	30
Ru-106	1.00E-05	1.82E-08	3E-06	3E-05	6.06E-04	7.75E-08	0.00E+00	0
Rh-103m	3.40E-05	6.18E-08	6E-03	6E-02	1.03E-06	2.63E-07	0.00E+00	0
Rh-106	1.00E-05	1.82E-08	0E+00	0E+00	-----	7.75E-08	0.00E+00	0
Te-125m	2.50E-05	4.54E-08	2E-05	2E-04	2.27E-04	1.94E-07	2.40E+05	0
Te-127m	2.60E-04	4.72E-07	9E-06	9E-05	5.25E-03	2.01E-06	1.62E+07	33
Te-127	2.70E-04	4.91E-07	1E-04	1E-03	4.91E-04	2.09E-06	1.48E+06	3
Te-129m	1.10E-03	2.00E-06	7E-06	7E-05	2.86E-02	8.52E-06	1.11E+05	1
Te-129	6.70E-04	1.22E-06	4E-04	4E-03	3.04E-04	5.19E-06	1.69E+07	88
I-130	1.20E-04	2.18E-07	2E-05	2E-04	1.09E-03	9.30E-07	2.65E+08	246
Te-131m	1.60E-04	2.91E-07	8E-06	8E-05	3.63E-03	1.24E-06	1.15E+06	1
Te-131	3.00E-05	5.45E-08	8E-05	8E-04	6.81E-05	2.32E-07	1.11E+08	26
I-131	1.60E-01	2.91E-04	1E-06	1E-05	2.91E+01	1.24E-03	1.18E+08	146287
Te-132	4.30E-03	7.81E-06	9E-06	9E-05	8.68E-02	3.33E-05	1.21E+08	4031
I-132	4.90E-03	8.90E-06	1E-04	1E-03	8.90E-03	3.80E-05	3.16E+08	11997
I-133	4.00E-02	7.27E-05	7E-06	7E-05	1.04E+00	3.10E-04	1.16E+08	35952
I-134	8.00E-05	1.45E-07	4E-04	4E-03	3.63E-05	6.20E-07	3.17E+08	196
Cs-134	4.60E-02	8.36E-05	9E-07	9E-06	9.29E+00	3.56E-04	2.42E+08	86254
I-135	4.30E-03	7.81E-06	3E-05	3E-04	2.60E-02	3.33E-05	1.47E+08	4898
Cs-136	8.90E-03	1.62E-05	6E-06	6E-05	2.69E-01	6.90E-05	3.19E+08	21998
Cs-137	3.30E-02	6.00E-05	1E-06	1E-05	6.00E+00	2.56E-04	9.30E+07	23779
Ba-137m	3.10E-02	5.63E-05	1E-06	1E-05	5.63E+00	2.40E-04	9.85E+07	23659
Ba-140	1.10E-04	2.00E-07	8E-06	8E-05	2.50E-03	8.52E-07	4.78E+07	41
La-140	1.10E-04	2.00E-07	9E-06	9E-05	2.22E-03	8.52E-07	2.22E+08	189
Ce-141	5.10E-05	9.27E-08	3E-05	3E-04	3.09E-04	3.95E-07	6.20E+07	24
Ce-143	2.80E-06	5.09E-09	2E-05	2E-04	2.54E-05	2.17E-08	7.87E+07	2
Ce-144	3.20E-05	5.81E-08	3E-06	3E-05	1.94E-03	2.48E-07	1.36E+07	3
Pr-143	2.70E-05	4.91E-08	2E-05	2E-04	2.45E-04	2.09E-07	0.00E+00	0
Pr-144	3.20E-05	5.81E-08	6E-04	6E-03	9.69E-06	2.48E-07	2.32E+06	1
H-3	5.50E+02	9.99E-01	1E-03	1E-02	9.99E+01	4.26E+00	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-08	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	5.50E+02	1.00E+00			1.53E+02	4.26E+00		407357
Total H-3	5.50E+02				9.99E+01	4.26E+00		0
Total W/O H-3	4.05E-01				5.28E+01	3.14E-03		407327

Ai: From ODCM 1/2-ODC-2.01 Table 1.1-1a (from Table 13 of S&W UR(B)-160)
Ei: (843-30 Data) From Calc Package No. ERS-SFL-92-039

F = 22800 gpm = Dilution Flowrate (15,000 gpm + 7,800 gpm)
f = 35 gpm = Discharge flowrate
Ct = 4.26E+00 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)
Ci = Si x Ct

CR = Sum (CiEi) = 4.07E+05 cpm
HHSP = CR = 4.07E+05 cpm
HSP = CR x 0.7 = 2.85E+05 cpm

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2SGC-RQ100 Alarm Setpoints

NEW METHOD - Based on: 10 x New 10 CFR 20 EC's

Nuclide	Ai Annual Release (Ci)	Si	New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	10 x New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	Si/EC (ml/uCi)	Ci (uCi/ml)	Bi Detection Efficiency (cpm/uCi/ml)	CiBi Count Rate (ncpm)
Cr-51	1.00E-04	1.82E-07	5E-04	5E-03	3.63E-05	3.92E-07	2.01E+07	8
Mn-54	2.50E-05	4.54E-08	3E-05	3E-04	1.51E-04	9.81E-08	1.27E+08	12
Fe-55	1.30E-04	2.36E-07	1E-04	1E-03	2.36E-04	5.10E-07	0.00E+00	0
Fe-59	6.50E-05	1.18E-07	1E-05	1E-04	1.18E-03	2.55E-07	1.26E+08	32
Co-58	1.10E-03	2.00E-06	2E-05	2E-04	9.99E-03	4.32E-06	1.82E+08	786
Co-60	1.60E-04	2.91E-07	3E-06	3E-05	9.69E-03	6.28E-07	2.38E+08	149
Zn-65	5.10E-02	9.27E-05	5E-06	5E-05	1.85E+00	2.00E-04	6.50E+07	13025
Np-239	3.20E-05	5.82E-08	2E-05	2E-04	2.91E-04	1.26E-07	1.65E+08	21
Br-83	2.90E-05	5.27E-08	9E-04	9E-03	5.86E-06	1.14E-07	2.42E+06	0
Br-84	5.90E-09	1.07E-11	4E-04	4E-03	2.68E-09	2.32E-11	1.38E+08	0
Rb-86	3.70E-05	6.72E-08	7E-06	7E-05	9.61E-04	1.45E-07	1.04E+07	2
Sr-89	2.20E-05	4.00E-08	8E-06	8E-05	5.00E-04	8.63E-08	1.83E+04	0
Sr-90	8.50E-07	1.54E-09	5E-07	5E-06	3.09E-04	3.34E-09	0.00E+00	0
Sr-91	5.30E-06	9.63E-09	2E-05	2E-04	4.82E-05	2.08E-08	1.04E+08	2
Mo-99	2.30E-03	4.18E-06	2E-05	2E-04	2.09E-02	9.03E-06	4.47E+07	403
Tc-99m	2.10E-03	3.82E-06	1E-03	1E-02	3.82E-04	8.24E-06	1.40E+08	1154
Te-125m	1.90E-06	3.45E-09	2E-05	2E-04	1.73E-05	7.46E-09	3.94E+05	0
Te-127m	2.10E-05	3.82E-08	9E-06	9E-05	4.24E-04	8.24E-08	1.26E+05	0
Te-127	2.50E-05	4.54E-08	1E-04	1E-03	4.54E-05	9.81E-08	2.43E+06	0
Te-129m	8.20E-05	1.49E-07	7E-06	7E-05	2.13E-03	3.22E-07	6.53E+06	2
Te-129	5.30E-05	9.63E-08	4E-04	4E-03	2.41E-05	2.08E-07	1.96E+07	4
I-130	2.30E-04	4.18E-07	2E-05	2E-04	2.09E-03	9.03E-07	5.18E+08	468
Te-131m	5.20E-05	9.45E-08	8E-06	8E-05	1.18E-03	2.04E-07	2.85E+08	58
Te-131	9.40E-06	1.71E-08	8E-05	8E-04	2.14E-05	3.69E-08	1.88E+08	7
I-131	1.00E-01	1.82E-04	1E-06	1E-05	1.82E+01	3.92E-04	1.96E+08	76924
Te-132	7.80E-04	1.42E-06	9E-06	9E-05	1.57E-02	3.06E-06	1.76E+08	539
I-132	2.30E-03	4.18E-06	1E-04	1E-03	4.18E-03	9.03E-06	4.22E+08	3809
I-133	6.50E-02	1.18E-04	7E-06	7E-05	1.69E+00	2.55E-04	1.73E+08	44133
I-134	4.60E-06	8.36E-09	4E-04	4E-03	2.09E-06	1.81E-08	4.06E+08	7
Cs-134	3.00E-02	5.45E-05	9E-07	9E-06	6.06E+00	1.18E-04	3.25E+08	38266
I-135	9.20E-03	1.67E-05	3E-05	3E-04	5.57E-02	3.61E-05	1.71E+08	6174
Cs-136	3.90E-03	7.09E-06	6E-06	6E-05	1.18E-01	1.53E-05	4.28E+08	6551
Cs-137	2.20E-02	4.00E-05	1E-06	1E-05	4.00E+00	8.63E-05	1.28E+08	11052
Ba-140	9.30E-06	1.69E-08	8E-06	8E-05	2.11E-04	3.65E-08	7.50E+07	3
La-140	8.40E-06	1.53E-08	9E-06	9E-05	1.70E-04	3.30E-08	3.08E+08	10
Y-90	6.00E-07	1.09E-09	7E-06	7E-05	1.56E-05	2.35E-09	0.00E+00	0
Y-91m	3.60E-06	6.54E-09	2E-03	2E-02	3.27E-07	1.41E-08	1.59E+08	2
Y-91	4.40E-06	8.00E-09	8E-06	8E-05	9.99E-05	1.73E-08	3.55E+05	0
Y-93	3.00E-07	5.45E-10	2E-05	2E-04	2.73E-06	1.18E-09	2.03E+07	0
Zr-95	4.00E-06	7.27E-09	2E-05	2E-04	3.63E-05	1.57E-08	1.35E+08	2
Nb-95	4.00E-06	7.27E-09	3E-05	3E-04	2.42E-05	1.57E-08	1.33E+08	2
Ru-103	2.70E-06	4.91E-09	3E-05	3E-04	1.64E-05	1.06E-08	1.71E+08	2
Ru-106	8.20E-07	1.49E-09	3E-06	3E-05	4.97E-05	3.22E-09	0.00E+00	0
Rh-103m	2.70E-06	4.91E-09	6E-03	6E-02	8.18E-08	1.06E-08	0.00E+00	0
Rh-106	8.20E-07	1.49E-09	0E+00	0E+00	-----	3.22E-09	5.65E+07	0
Ce-141	4.00E-06	7.27E-09	3E-05	3E-04	2.42E-05	1.57E-08	7.75E+07	1
Ce-143	8.60E-07	1.56E-09	2E-05	2E-04	7.81E-06	3.38E-09	1.20E+08	0
Ce-144	2.60E-06	4.72E-09	3E-06	3E-05	1.57E-04	1.02E-08	1.87E+07	0
Pr-143	2.30E-06	4.18E-09	2E-05	2E-04	2.09E-05	9.03E-09	1.63E+00	0
Pr-144	2.60E-06	4.72E-09	6E-04	6E-03	7.87E-07	1.02E-08	3.40E+06	0
H-3	5.50E+02	9.99E-01	1E-03	1E-02	9.99E+01	2.16E+00	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-08	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	5.50E+02	1.00E+00			1.32E+02	2.16E+00		203612
Total H-3	5.50E+02				9.99E+01	2.16E+00		0
Total W/O H-3	2.91E-01				3.20E+01	1.14E-03		203612

Ai: From ODCM 1/2-ODC-2.01 Table 1.1-1b (from Table 13 of S&W UR(B)-160)
Bi: (RD-53 Data) From Calc Package No. ERS-SFL-86-026

F = 22800 gpm = Dilution Flowrate (15,000 gpm + 7,800 gpm)
f = 80 gpm = Discharge flowrate
Ct = 2.16E+00 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)
Ci = Si x Ct

CR = Sum CiBi =	203612	cpm
Eia (W/O H-3) = (CR) / (Sum Ci) =	1.78E+08	cpm/uCi/ml
CF-11 Conversion Factor = 1 / Eia =	5.61E-09	uCi/ml/cpm
DV = CF11 x (Sum CiBi) =	1.14E-03	uCi/ml
HSP = DV =	1.14E-03	uCi/ml
ASP = DV x 0.7 =	7.99E-04	uCi/ml

2SWS-RQ101 & Alarm Setpoints
2SWS-RQ102

NEW METHOD - Based on: 10 x New 10 CFR 20 EC's

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Nuclide	Ai Annual Release (Ci)	Si	New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	10 x New 10 CFR 20 EC Appendix B Table 2, Col 2 (uCi/ml)	Si/EC (ml/uCi)	Ci (uCi/ml)	Ei Detection Efficiency (cpm/uCi/ml)	CiEi Count Rate (ncpm)
Cr-51	2.00E-03	7.51E-04	5E-04	5E-03	1.50E-01	5.16E-08	2.01E+07	1
Mn-54	3.30E-04	1.24E-04	3E-05	3E-04	4.13E-01	8.52E-09	1.27E+08	1
Fe-55	1.70E-03	6.38E-04	1E-04	1E-03	6.38E-01	4.39E-08	0.00E+00	0
Fe-59	1.10E-03	4.13E-04	1E-05	1E-04	4.13E+00	2.84E-08	1.26E+08	4
Co-58	1.70E-02	6.38E-03	2E-05	2E-04	3.19E+01	4.39E-07	1.82E+08	80
Co-60	2.10E-03	7.88E-04	3E-06	3E-05	2.63E+01	5.42E-08	2.38E+08	13
Zn-65	5.10E-02	1.91E-02	5E-06	5E-05	3.83E+02	1.32E-06	6.50E+07	86
Np-239	1.30E-03	4.88E-04	2E-05	2E-04	2.44E+00	3.35E-08	1.65E+08	6
Br-83	5.50E-03	2.06E-03	9E-04	9E-03	2.29E-01	1.42E-07	2.42E+06	0
Br-84	3.00E-03	1.13E-03	4E-04	4E-03	2.81E-01	7.74E-08	1.38E+08	11
Br-85	3.50E-04	1.31E-04	0E+00	0E+00	-----	9.03E-09	9.04E+06	0
Rb-86	9.10E-05	3.41E-05	7E-06	7E-05	4.88E-01	2.35E-09	1.04E+07	0
Rb-88	2.30E-01	8.63E-02	4E-04	4E-03	2.16E+01	5.94E-06	4.84E+07	287
Sr-89	3.70E-04	1.39E-04	8E-06	8E-05	1.74E+00	9.55E-09	1.83E+04	0
Sr-90	1.10E-05	4.13E-06	5E-07	5E-06	8.26E-01	2.84E-10	0.00E+00	0
Sr-91	7.20E-04	2.70E-04	2E-05	2E-04	1.35E+00	1.86E-08	1.04E+08	2
Mo-99	9.00E-02	3.38E-02	2E-05	2E-04	1.69E+02	2.32E-06	4.47E+07	104
Tc-99m	5.40E-02	2.03E-02	1E-03	1E-02	2.03E+00	1.39E-06	1.40E+08	195
Te-125m	3.10E-05	1.16E-05	2E-05	2E-04	5.82E-02	8.00E-10	3.94E+05	0
Te-127m	3.00E-04	1.13E-04	9E-06	9E-05	1.25E+00	7.74E-09	1.26E+05	0
Te-127	9.40E-04	3.53E-04	1E-04	1E-03	3.53E-01	2.43E-08	2.43E+06	0
Te-129m	1.50E-03	5.63E-04	7E-06	7E-05	8.04E+00	3.87E-08	6.53E+06	0
Te-129	1.80E-03	6.75E-04	4E-04	4E-03	1.69E-01	4.65E-08	1.96E+07	1
I-130	2.30E-03	8.63E-04	2E-05	2E-04	4.32E+00	5.94E-08	5.19E+08	31
Te-131m	2.70E-03	1.01E-03	8E-06	8E-05	1.27E+01	6.97E-08	2.85E+08	20
Te-131	1.30E-03	4.88E-04	8E-05	8E-04	6.10E-01	3.35E-08	1.88E+08	6
I-131	2.90E-01	1.09E-01	1E-06	1E-05	1.09E+04	7.48E-06	1.96E+08	1467
Te-132	2.90E-02	1.09E-02	9E-06	9E-05	1.21E+02	7.48E-07	1.76E+08	132
I-132	1.10E-01	4.13E-02	1E-04	1E-03	4.13E+01	2.84E-06	4.22E+08	1198
I-133	4.20E-01	1.58E-01	7E-06	7E-05	2.25E+03	1.08E-05	1.73E+08	1875
I-134	5.40E-02	2.03E-02	4E-04	4E-03	5.07E+00	1.39E-06	4.06E+08	566
Cs-134	2.70E-02	1.01E-02	9E-07	9E-06	1.13E+03	6.97E-07	3.25E+08	226
I-135	2.10E-01	7.88E-02	3E-05	3E-04	2.63E+02	5.42E-06	1.71E+08	927
Cs-136	1.40E-02	5.25E-03	6E-06	6E-05	8.76E+01	3.61E-07	4.28E+08	155
Cs-137	1.90E-02	7.13E-03	1E-06	1E-05	7.13E+02	4.90E-07	1.28E+08	63
Ba-137m	1.90E-02	7.13E-03	1E-06	1E-05	7.13E+02	4.90E-07	1.33E+08	65
Ba-140	2.30E-04	8.63E-05	8E-06	8E-05	1.08E+00	5.94E-09	7.50E+07	0
La-140	1.60E-04	6.00E-05	9E-06	9E-05	6.67E-01	4.13E-09	3.08E+08	1
Y-90	1.30E-06	4.88E-07	7E-06	7E-05	6.97E-03	3.35E-11	0.00E+00	0
Y-91m	4.20E-04	1.58E-04	2E-03	2E-02	7.88E-03	1.08E-08	1.59E+08	2
Y-91	6.80E-05	2.55E-05	8E-06	8E-05	3.19E-01	1.75E-09	3.55E+05	0
Y-93	3.80E-05	1.43E-05	2E-05	2E-04	7.13E-02	9.81E-10	2.03E+07	0
Zr-95	6.30E-05	2.36E-05	2E-05	2E-04	1.18E-01	1.63E-09	1.35E+08	0
Nb-95	5.30E-05	1.99E-05	3E-05	3E-04	6.63E-02	1.37E-09	1.33E+08	0
Ru-103	4.70E-05	1.76E-05	3E-05	3E-04	5.88E-02	1.21E-09	1.71E+08	0
Ru-106	1.10E-05	4.13E-06	3E-06	3E-05	1.38E-01	2.84E-10	0.00E+00	0
Rh-103m	5.20E-05	1.95E-05	6E-03	6E-02	3.25E-04	1.34E-09	0.00E+00	0
Rh-106	1.20E-05	4.50E-06	0E+00	0E+00	-----	3.10E-10	5.65E+07	0
Ce-141	7.40E-05	2.78E-05	3E-05	3E-04	9.26E-02	1.91E-09	7.75E+07	0
Ce-143	4.30E-05	1.61E-05	2E-05	2E-04	8.07E-02	1.11E-09	1.20E+08	0
Ce-144	3.50E-05	1.31E-05	3E-06	3E-05	4.38E-01	9.03E-10	1.87E+07	0
Pr-143	5.30E-05	1.99E-05	2E-05	2E-04	9.94E-02	1.37E-09	1.63E+00	0
Pr-144	3.80E-05	1.43E-05	6E-04	6E-03	2.38E-03	9.81E-10	3.40E+06	0
H-3	1.00E+00	3.75E-01	1E-03	1E-02	3.75E+01	2.58E-05	0.00E+00	0
All Others	0.00E+00	0.00E+00	1E-08	1E-07	0.00E+00	0.00E+00	0.00E+00	0
Total	2.66E+00	1.00E+00			1.69E+04	6.88E-05		7525
Total H-3	1.00E+00				3.75E+01	2.58E-05		0
Total W/O H-3	1.66E+00				1.69E+04	4.30E-05		7525

Ai: From S & W Calc Package No. UR(B) 299-0
Ei: (RD-53 Data) From Calc Package No. ERS-SFL-86-026

F = 8400 gpm = Dilution Flowrate
f = 7220 gpm = Discharge flowrate
Ct = 6.88E-05 = Dilution Flowrate / (Discharge Flowrate x Sum Si/MPC)
Ci = Si x Ct

CR = Sum CiEi =	7525	cpm
Eia (W/O H-3) = (CR) / (Sum Ci) =	1.75E+08	cpm/uCi/ml
CF-11 Conversion Factor = 1 / Eia =	5.71E-09	uCi/ml/cpm
DV = CF11 x (Sum CiEi) =	4.30E-05	uCi/ml
HSP = DV =	4.30E-05	uCi/ml
ASP = DV x 0.7 =	3.01E-05	uCi/ml

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Determination of Zn-65 Ci/yr value for ODCM Table 1.1-1a & 1.1-1b

Unit 1 (For ODCM 1/2-ODC-2.01 Table 1.1-1a):

1) Letdown Volume Determination:
    60 gpm = RCS Letdown Rate from 1/2-ODC-3.01 Table B:1a
    3.15E+07 gal = Total RCS Volume Letdown in 1 yr , or
        gal = gpm x 60 min/hr x 24 hr/day x 365 day/yr
    1.19E+11 ml = Total Volume converted to ml , or
        ml = gal x 3785 ml/gal

2) Determination of Activity Input to Liquid Waste in 1 yr
    4.50E-03 uCi/ml = Estimate of RCS Zn-65 Concentration
    5.37E+08 uCi = Estimate of RCS Zn-65 Activity Input to LW in 1 yr
    5.37E+02 Ci = Zn-65 Liquid Waste Input Activity converted to Ci, or
        Ci = uCi x 1E-6 Ci/uCi

3) Determination of Zn-65 Activity Release for 1/2-ODC-2.01 Table 1.1-1a
    20000 DF = Total Zn-65 Decontamination Factor thru all CVCS & LW Filters & Demineralizers.
        NOTE: This value was derived from the values listed in ODCM 1/2-ODC-3.01 Table B:1a. Although this table lists "other" DF's as 1E+7, a more appropriate value of 20000 is used (ie; the lowest of all DF's listed).
    2.69E-02 Ci = Estimate of Zn-65 Activity Release per year , or
        Ci = Ci / DF)

Unit 2 (For ODCM 1/2-ODC-2.01 Table 1.1-1b):

1) Letdown Volume Determination:
    57 gpm = RCS Letdown Rate from 1/2-ODC-3.01 Table B:1b
    3.00E+07 gal = Total RCS Volume Letdown in 1 yr , or
        gal = gpm x 60 min/hr x 24 hr/day x 365 day/yr
    1.13E+11 ml = Total Volume converted to ml , or
        ml = gal x 3785 ml/gal

2) Determination of Activity Input to Liquid Waste in 1 yr
    4.50E-03 uCi/ml = Estimate of RCS Zn-65 Concentration
    5.10E+08 uCi = Estimate of RCS Zn-65 Activity Input to LW in 1 yr
    5.10E+02 Ci = Zn-65 Liquid Waste Input Activity converted to Ci, or
        Ci = uCi x 1E-6 Ci/uCi

3) Determination of Zn-65 Activity Release for 1/2-ODC-2.01 Table 1.1-1b
    10000 DF = Total Zn-65 Decontamination Factor thru all CVCS & LW Filters & Demineralizers.
        NOTE: This value was derived from the values listed in ODCM 1/2-ODC-3.01 Table B:1b. Although this table lists "other" DF's as high as 1E+5, a more appropriate value of 10000 is used (ie; the lowest of all "other" DF's listed).
    5.10E-02 Ci = Estimate of Zn-65 Activity Release per year , or
        Ci = Ci / DF)

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[redacted]

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FLUKE. Biomedical

FLUKE Biomedical
Radiation Management Services
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From: Andy Lasko
Project Manager,
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Telephone: (440)542-3611
Telefax: (440)349-8059

Date: April 19, 2006

Subject: Revised Model 843-30R Efficiencies

Mr. Vakharia

Enclosed are revised isotopic efficiencies for the Model 843-30R Gamma Scintillation detector used in your liquid and gaseous effluent radiation monitors. Four (4) sets of efficiency tables are enclosed. Each table reflects the efficiency for each of the sampling geometries used in your plant.

The source of the efficiency data is our primary isotopic calibration report 958.402. This report documents the primary isotopic calibration performed on the Model 843-30R detector in our Model 841-334 three (3) Liter Off-line liquid sampling geometry. The Model 841-334 is our current version of your Model 841-3N three (3) liter Off-line sampling geometry. The sample volume and detector location in both sampling geometries is the same, and the data taken with our Model 841-334 will apply directly to your Model 841-3N.

To obtain revised efficiencies for your Letdown monitor and Gaseous effluent monitors, the ratio between your original liquid monitor efficiency and the new efficiency was calculated for each isotope. The efficiency ratio was then applied to the previous letdown monitor and gaseous effluent monitor isotopic efficiencies, and a new efficiency was calculated. We believe this approach is valid because the detector response has been validated in report 958.402. What changes in the letdown and gaseous effluent monitors is the sampling geometry. By knowing the response difference of the detector from the primary liquid isotopic calibration, and the previous response of the letdown and gaseous monitor sampling geometries, a new efficiency for the letdown and gaseous geometries may be obtained by multiplying the original efficiencies by the difference in detector efficiencies.

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The results of this analysis are provided on the four (4) tables enclosed.

Please feel free to contact us should you have any questions or comments on the above.

Sincerely Yours,

Andrew Lasko
Project Manager
FLUKE Biomedical
Radiation Management Services
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BVPS Unit 1 Liquid Radiation Monitors Rev. 1.01 4/17/2006

Gamma Sensitivities of the 841-3N & 843-30 with 67 kv Baseline to Liquids

Monitors: RM-1LW-104 and RM-1LW-116: Liquid Waste and Laundry Drains Effluent Monitors
RM-1SS-100 and RM-1BD-100: Steam Generator Secondary Blowdown Sample and Blowdown Monitors
RM-1AS-100: Auxiliary Steam Condensate Monitor
RM-1CC-100: Component Cooling Water Monitor
RM-1RW-101: Component Cooling Heat Exchanger River Water Monitor
RM-1RW-100A, RM-1RW-100B, and RM-1RW-100C: Reciro Spray Heat Exchanger River Water Monitors
RM-1RW-100: Component Cooling / Reciro Spray Heat Exchanger River Water Monitors
RM-1DA-100: Aux Feedwater Area Drain Tank

	Nuclide	(1) 843-30 Detection Efficiency (cpm/uCi/ml)	(2) 843-30 Detection Efficiency (cpm/uCi/ml)	(3) 843-30R Detection Efficiency (cpm/uCi/ml)	CF
1	Cr-51		1.18E+07	1.24E+07	1.0476
2	Co-58	1.18E+08	1.16E+08	1.06E+08	0.9113
3	Co-60	1.72E+08	1.73E+08	1.94E+08	1.1186
4	Rb-88	3.36E+07		3.73E+07	1.1088
5	Sr-89	7.84E+03		9.84E+03	1.2547
6	Sr-90	0.00E+00		0.00E+00	0.0000
7	Y-90	1.72E+04		0.00E+00	0.0000
8	Sr-91	1.27E+03	6.97E+07	8.13E+07	1.1667
9	Y-91	2.58E+05	2.60E+05	2.53E+05	0.9760
10	Zr-95	8.73E+07	8.60E+07	1.06E+08	1.2312
11	Nb-95	8.37E+07	8.64E+07	1.06E+08	1.2288
12	Zr-97		2.21E+07	1.17E+08	5.3105
13	Mo-99	2.42E+07	2.84E+07	1.41E+08	4.9605
14	Tc-99m	9.00E+07	8.96E+07	1.11E+08	1.2432
15	Ru-103		9.50E+07	1.13E+08	1.1911
16	Ru-105		1.30E+08	7.84E+07	0.6035
17	Ru-106			0.00E+00	0.0000
18	Rh-105		2.96E+07	3.07E+07	1.0373
19	Te-127m		4.09E+04	1.62E+07	395.9642
20	Te-127		1.38E+06	1.48E+06	1.0739
21	Sb-127		1.09E+08	1.25E+08	1.1499
22	Sb-129		1.50E+08	1.47E+08	0.9812
23	Te-129m		4.02E+06	1.11E+05	0.0277
24	Te-129	1.91E+07	1.12E+07	1.69E+07	1.5132
25	Te-131m		1.82E+08	1.15E+06	0.0063
26	I-131	1.06E+08	1.11E+08	1.18E+08	1.0660
27	Te-132	1.17E+08	1.17E+08	1.21E+08	1.0316
28	I-132	2.75E+08	2.66E+08	3.16E+08	1.1884
29	I-133	1.01E+08	9.90E+07	1.16E+08	1.1733
30	I-134	2.42E+08	2.70E+08	3.17E+08	1.1756
31	I-135	1.22E+08	1.19E+08	1.47E+08	1.2323
32	Cs-137	7.65E+07	8.01E+07	9.30E+07	1.1616
33	Ba-137m		8.01E+07	9.85E+07	1.2298
34	Ba-140	5.21E+07	4.37E+07	4.78E+07	1.0937
35	La-140	1.73E+08	2.00E+08	2.22E+08	1.1118
36	Ce-141		5.07E+07	6.20E+07	1.2239
37	Ce-143		7.27E+07	7.87E+07	1.0832
38	Ce-144	1.08E+07	1.06E+07	1.36E+07	1.2837
39	Pr-143		1.04E+00	0.00E+00	0.0000
40	Pr-144	2.21E+06	2.25E+06	2.32E+06	1.0323
41	Nd-147		3.12E+07	3.37E+07	1.0808
42	H-3		0.00E+00	0.00E+00	0.0000
43	Ar-41		8.59E+07	9.54E+07	1.1103
44	Kr-79		6.32E+07	5.32E+07	0.8412
45	Kr-81		4.49E+06	4.51E+06	1.0050
46	Kr-85	7.60E+05	4.25E+05	4.98E+07	117.273
47	Kr-85m	9.45E+07	9.94E+07	1.17E+08	1.1729
48	Kr-87	1.39E+08	8.28E+07	8.73E+07	1.0540
49	Kr-88	1.11E+08	1.29E+08	1.30E+08	1.0114
50	Kr-89		1.57E+08	1.62E+08	1.0334
51	Kr-90		1.48E+08	1.79E+08	1.2127
52	Xe-131M		2.28E+06	2.63E+06	1.1517

BVPS Unit 1 Liquid Radiation Monitors Rev. 1.01 4/17/2006

Gamma Sensitivities of the 841-3N & 843-30 with 67 kv Baseline to Liquids

Monitors: RM-1LW-104 and RM-1LW-116: Liquid Waste and Laundry Drains Effluent Monitors
RM-1SS-100 and RM-1BD-100: Steam Generator Secondary Blowdown Sample and Blowdown Monitors
RM-1AS-100: Auxiliary Steam Condensate Monitor
RM-1CC-100: Component Cooling Water Monitor
RM-1RW-101: Component Cooling Heat Exchanger River Water Monitor
RM-1RW-100A, RM-1RW-100B, and RM-1RW-100C: Recirc Spray Heat Exchanger River Water Monitors
RM-1RW-100: Component Cooling / Recirc Spray Heat Exchanger River Water Monitors
RM-1DA-100: Aux Feedwater Area Drain Tank

	Nuclide	(1) 843-30 Detection Efficiency (cpm/uCi/ml)	(2) 843-30 Detection Efficiency (cpm/uCi/ml)	(3) 843-30R Detection Efficiency (cpm/uCi/ml)	CF
53	Xe-133	9.25E+06	9.72E+06	9.01E+06	0.9266
54	Xe-133m	1.61E+07	1.32E+07	1.37E+07	1.0341
55	Xe-135	1.19E+08	1.18E+08	1.22E+08	1.0379
56	Xe-135m	7.78E+07	7.84E+07	9.27E+07	1.1829
57	Xe-137		3.49E+07	3.93E+07	1.1248
58	Xe-138	3.20E+08	1.28E+08	1.33E+08	1.0413
59	I-130		3.08E+08	2.65E+08	0.8589
60	I-136		1.37E+08	3.72E+08	2.7163
61	Na-24		1.73E+08	9.52E+07	0.5500
62	Mn-54	8.80E+07	8.59E+07	1.05E+08	1.2172
63	Mn-56	1.35E+08	1.13E+08	1.42E+08	1.2564
64	Fe-59	9.00E+07	9.17E+07	1.04E+08	1.1294
65	Co-57		7.97E+07	1.04E+08	1.3014
66	Co-60m		2.15E+05	0.00E+00	0.0000
67	Ni-65		3.98E+07	4.48E+07	1.1258
68	Cu-64		3.55E+07	4.51E+05	0.0127
69	Zn-65		4.67E+07	5.02E+07	1.0742
70	Br-83		1.36E+06	1.48E+06	1.0859
71	Br-84	1.16E+08	9.75E+07	3.16E+08	3.2442
72	Br-85		6.19E+06	6.71E+06	1.0837
73	Rb-89	1.57E+08		1.52E+08	0.9659
74	Sr-92	8.54E+07	9.16E+07	1.03E+08	1.1228
75	Y-90m		2.02E+11	2.37E+08	0.0012
76	Y-91m		8.98E+07	1.07E+08	1.1959
77	Y-92	2.14E+07	2.35E+07	2.74E+07	1.1654
78	Tc-99		2.15E+02	3.97E+02	1.8456
79			3.26E+07	3.84E+07	1.1779
80	Ag-110m		2.79E+08	3.35E+08	1.1999
81	Sb-124		1.69E+08	1.95E+08	1.1512
82	Sb-125		8.71E+07	1.01E+08	1.1641
83	Te-125m		1.83E+05	2.40E+05	1.3131
84	Te-131		1.20E+08	1.11E+08	0.9241
85	Te-133		1.66E+08	1.59E+08	0.9592
86	Te-133m		2.68E+08	8.96E+06	0.0334
87	Te-134	7.27E+07	1.97E+08	2.26E+08	1.1458
88	I-129	0.00E+00		0.00E+00	0.0000
89	Cs-134	2.06E+08	1.99E+08	2.42E+08	1.2156
90	Cs-134m		1.13E+07	1.43E+07	1.2623
91	Cs-136	3.02E+08	2.80E+08	3.19E+08	1.1388
92	Cs-138	1.51E+08		1.95E+08	1.2901
93	Ba-139		2.07E+07	3.21E+07	1.5530
94	Np-237		8.49E+07	1.08E+07	0.1269

(1) Original Gamma Sensitivities from Addendum to BVPS Spec No. BVS-414, Table V, 10-7-74
(2) Adjusted Gamma Sensitivities from Calculation Package No. ERS-SFL-92-039
(3) Gamma Sensitivities from Fluke Biomedical for Replacement Detector

Evaluation of the effect on [RM-1DA-100] Alarm Setpoints due to Detector Upgrade

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CONCLUSION:

The alarm setpoints for the analog drawer/meter face of [RM-1DA-100], as previously provided in Calculation No. 8700-UR(B)-223, Rev 0, are still valid and do not require revision. Therefore, the alarm setpoints SHALL remain at the current values, as follows:

HHSP = 1.20E+04 cpm
HSP = 8.43E+03 cpm

The EPP Emergency Action Level values, as documented in EAL 7.2 (Liquid Effluents) Table 7-1 (Effluent Radiation Monitor EALs), are still valid and do not require revision. Therefore, the EPP-EAL values SHALL remain at the current values, as follows:

EPP UE EAL = 2.44E+04 cpm
EPP Alert EAL = NA; Range Exceeded

However, IF the analog drawer/meter face of [RM-1DA-100] is upgraded to a digital drawer/meter face, THEN the revised setpoints shall be applied. This would require changes to 1/2-ODC-2.01, 1-HPP-4.02.013 and EPP-I-1a Table 7-1.

DISCUSSION:

On 11/16/08, Unit 1 Aux Feedwater Area Drain Radiation Monitor [RM-1DA-100] was removed from service for calibration via 1MSP-43.70-I. Several attempts were made to calibrate the monitor using the existing Model 843-32 Detector, along with two (2) other new Model 843-32 Detectors, but the attempts were unsuccessful (See CR08-50435 & CR08-50765). The vendor was contacted for resolution, and they suggested that the Model 843-32 Detector be replaced with the upgraded Model 843-32R Detector, because the original Model 843-32 Detectors are no longer manufactured, and any available Model 843-32 Detectors (although new) may not give desired results. For information, the Model 843-32 Detectors were last manufactured ~14 years ago, and the crystals may exhibit different characteristics than those provided at time of manufacture.

In order to change FROM the Model 843-32 Detector TO the Model 843-32R Detector, an evaluation of the alarm setpoints needed performed. Specifically, the evaluation needed to determine effect on the current alarm setpoints of [RM-1DA-100], as previously provided in Calculation No. 8700-UR(B)-223, Rev 0 (Impact of Atmospheric Containment Conversion, Power Uprate, and Alternate Source Terms on the Alarm setpoints for the Radiation Monitors at BVPS-1), due to vendor upgrade FROM the Model 843-32 gamma scintillation detector TO the Model 843-32R replacement gamma scintillation detector.

On 12/18/08, the vendor provided documentation of the efficiencies for the 843-32R Detector, indicating that the efficiencies are the same as those previously provided for the 843-30R Detector. Using this technical bass, calculations were performed using the efficiencies for the Model 843-30R Detector. The results indicated that any calculated changes in alarm setpoints, and any calculated changes in EPP-EAL values were insignificant, and therefore, should remain at the values shown in the calculation of record. Specifically the calculation of record is 8700-UR(B)-223, Rev 0. A comparison of the setpoints and EPP-EAL values are as follows:

HHSP Summary
Re-Evaluated HHSP (843-32R) = CR = 1.22E+04 cpm, or 1.5% increase from Current HHSP
Re-Evaluated HHSP (843-32) = 1.05E+04 cpm, or 12.8% decrease from Current HHSP
Current HHSP (843-32) = 1.20E+04 cpm
HSP Summary
Re-Evaluated HSP (843-32R) = CR x 0.7 = 8.52E+03 cpm, or 1.1% increase from Current HSP
Re-Evaluated HSP (843-32) = 7.33E+03 cpm, or 13.1% decrease from Current HSP
Current HSP (843-32) = 8.43E+03 cpm
UE-EAL Summary
Re-Evaluated UE-EAL (843-32R) = 2 x HHSP = 2.44E+04 cpm, or NO change from Current UE-EAL
Re-Evaluated UE-EAL (843-32) = 2.09E+04 cpm, or 14.2% decrease from Current UE-EAL
Current UE-EAL (843-32) = 2.44E+04 cpm
Alert-EAL Summary
Re-Evaluated Alert-EAL (843-32R) = 200 x HHSP = 2.44E+06 cpm, or NO change from Current Alert-EAL
Re-Evaluated Alert-EAL (843-32) = 2.09E+06 cpm, or 14.2% decrease from Current Alert-EAL
Current Alert-EAL = 2.44E+06 cpm
NOTE: SINCE the calculated Alert-EAL values exceed the range of the instrument, THEN the actual Alert-EAL values are "Not Applicable"

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EVALUATION:

Part 1: Significance of Changes

The changes noted above are considered insignificant for the following reasons:

1. HHSP Values: The calculated HHSP values, although shown in three (3) significant figures, are not able to be set to that accuracy on the meter face. Specifically, [RM-1DA-100] has an analog meter face that covers five decades (i.e., 10 to 1E+6 cpm), which restricts the end-user to interpolate a setpoint (i.e., 1.22E+04 cpm, 1.05E+04 cpm and 1.20E+04 cpm) beyond one (1) significant figure. In summary, the calculated HHSP values of 1.22E+04 cpm, 1.05E+04 cpm and 1.20E+04 cpm would all be read as the identical value of 1E+04 cpm.

2. HSP Values: The calculated HSP values, although shown in three (3) significant figures, are not able to be set to that accuracy on the meter face. Specifically, [RM-1DA-100] has an analog meter face that covers five decades (i.e., 10 to 1E+6 cpm), which restricts the end-user to be able to interpolate the setpoint (i.e., 8.52E+03 cpm, 7.33E+03 cpm and 8.43E+03 cpm) equal to or beyond one (1) significant figure. Specifically, SINCE the meter face has "hash marks" at 1, 2, 4, 6, 8 & 10, THEN the end-user would also have difficulty interpolating setpoints between 7E+03 and 9E+03 cpm. In summary, the calculated HSP values of 8.52E+03 cpm, 7.33E+03 cpm and 8.43E+03 cpm would most likely be set at the 8E+03 cpm "hash mark", which makes these values identical.

3. Alert Values: The calculated Alert-EAL values, although shown in three (3) significant figures, are not able to be read to that accuracy on the meter face. Specifically, [RM-1DA-100] has an analog meter face that covers five decades (i.e., 10 to 1E+6 cpm), which restricts the end-user to interpolate a reading (i.e., 2.44E+06 cpm, 2.09E+06 cpm and 2.44E+06 cpm) beyond the range of the instrument. In summary, the calculated Alert-EAL values of 2.44E+06 cpm, 2.09E+06 cpm and 2.44E+06 cpm are "Not Applicable", because they exceed the maximum instrument range of 1E+06 cpm.

4. UE-EAL Values: The calculated UE-EAL values, although shown in three (3) significant figures, are not able to be read to that accuracy on the meter face. Specifically, [RM-1DA-100] has an analog meter face that covers five decades (i.e., 10 to 1E+6 cpm), which restricts the end user to interpolate a reading (i.e., 2.44E+04 cpm, 2.09E+04 cpm and 2.44E+04 cpm) beyond one (1) significant figure. In summary, the calculated UE-EAL values of 2.44E+04 cpm, 2.09E+04 cpm and 2.44E+04 cpm would all be read as the identical value of 2E+04 cpm.

5. Summary of Differences: The differences between all the Re-Evaluated and Current values range from -14.2% change to +1.5% change. In summary, the difference between all Re-Evaluated and Current values are insignificant, because they represent similar values when read on the meter face.

6. Setpoint Truncation Practice: The actual practice for alarm setpoint adjustment of radiation monitors with analog meter faces is to truncate the 2nd and 3rd significant figure from the net alarm setpoint. For example, a calculated net alarm setpoint of up to 1.99E+04 cpm is truncated to 1E+4 cpm prior to adjustment of the alarm setpoint. In summary all Re-Evaluated and Current values are similar when read on the meter face.

7. Impact on Digital Upgrade: All justifications provided in Items 1-6 above are valid only during periods where the analog drawer/meter face is installed in [RM-1DA-100. Therefore, IF the analog drawer/meter face of [RM-1DA-100] is upgraded to a digital drawer/meter face, THEN the revised setpoints shall be applied. This would require changes to 1/2-ODC-2.01, 1-HPP-4.02.013 and EPP-I-1a Table 7-1.

Part 2: Graphic of Victoreen Analog Meter Face